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The AIRCRAFT ENGINEER AND AIRSHIPS

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Commercial Aircraft and Airports Number

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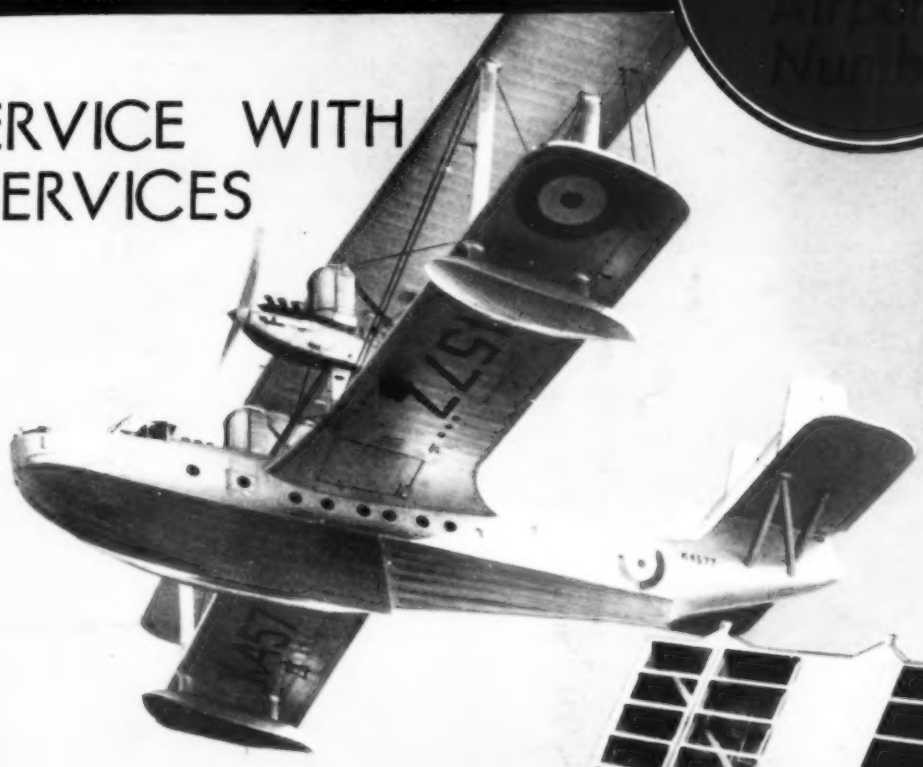

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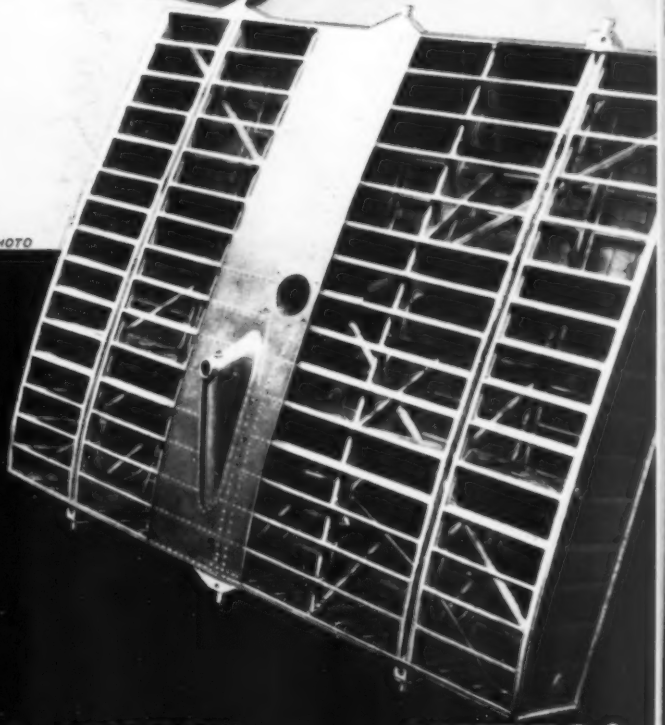

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FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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Getting Together

FEW aeronautical events have started with greater promise of useful practical results than the Airports Conference and Exhibition which was due to be officially opened by Lord Swinton, the Secretary of State for Air, yesterday. Not only is the Exhibition—at the Central Hall, Westminster—a large and representative one, at which no fewer than fifty firms are showing products used in connection with airports, their buildings and equipment, but the visitors include delegates from nearly thirty townships drawn from all over the country. These delegates will have the opportunity to study a paper by Mr. Brueton, Town Planning Officer of the Bristol Corporation, on the application of town planning regulations to aerodromes, and to discuss problems connected with this subject.

Flight has, during the past year, published a considerable number of opinions on the somewhat vexed question of aerodrome fees and charges, and we therefore naturally welcome the discussion of this subject during to-day's session. It seems, however, a little regrettable that the conference will, it is understood, confine itself to a discussion of the general principles involved, and that no attempt will be made to arrive at definite scales. However, presumably such details will be settled by correspondence among those directly concerned. It is to be hoped that no time will be lost. The matter is in urgent need of settlement without delay.

One cannot avoid feeling keen disappointment at the long delay in issuing the Maybury Committee Report, which, at the time of writing, has still not appeared. The announcement by the Aerodrome Owners' Association of the prospect that "the report of the Maybury Committee, appointed by the Air Ministry to examine British home civil aviation and to make recommendations, may be available before the Conference breaks up," does not seem to help matters very much. That report ought to have been issued at least a fortnight ago so as to give delegates to the Conference an opportunity to study it thoroughly. As it is, even if the Maybury Report *is* issued "before the Conference breaks up," there will be no time to read it or to digest its contents. Thus a golden opportunity has been lost. One wonders whether the Air Ministry prefers to avoid a too searching study of the report and a too pertinent discussion of its recommendations.

Ultimate Responsibility

THE rider added by the jury at the resumed inquest on the fifteen people who lost their lives in the K.L.M. accident at Croydon on December 9, to the effect that the final decision as to whether aircraft should take off in bad visibility should rest with an officially appointed authority at the airport, has once more raised a subject which has been studied often. One can understand the feeling of the members of the jury which prompted this rider; it is more difficult to agree with the rider.

From weather reports received at the aerodrome, conditions along any particular route are known, and at present the decision of putting "Q.B.I." into force rests quite rightly with the authorities on the ground. The weather conditions at both termini are also known, and superficially it might well appear that those most qualified to decide whether or not a pilot is to take off would be these same authorities. The matter is not, however, quite as simple as it appears on the surface.

Commercial aircraft differ considerably in their handling characteristics, on the ground and in the air. Some are known to have a tendency to swing when the throttles are opened. Most twin-engined aeroplanes have this tendency to a greater or smaller degree. The manner in which the gyros of the blind-flying equipment are driven has a bearing on the subject of take-off in poor visibility. With some installations there is a perceptible lag, which may reduce the sensitivity during the initial stages. The point is that only the pilot can possibly know whether or not he is safe to take off any

particular aeroplane with any particular equipment in any particular conditions.

In the case of the K.L.M. Douglas it seems to be proved beyond question that the machine swung to one side after running 200 yards. What was the cause of this was not ascertained. It may be that in an aircraft travelling at something like 70 m.p.h. the white line is more easily lost than in one which takes off at just over 50 m.p.h. That, however, merely raises the question of a possibly better form of thick-weather guide for pilots. It does not introduce the need for taking away from the pilot the right to give the ultimate decision on whether or not to take off.

Let Us Simplicate!

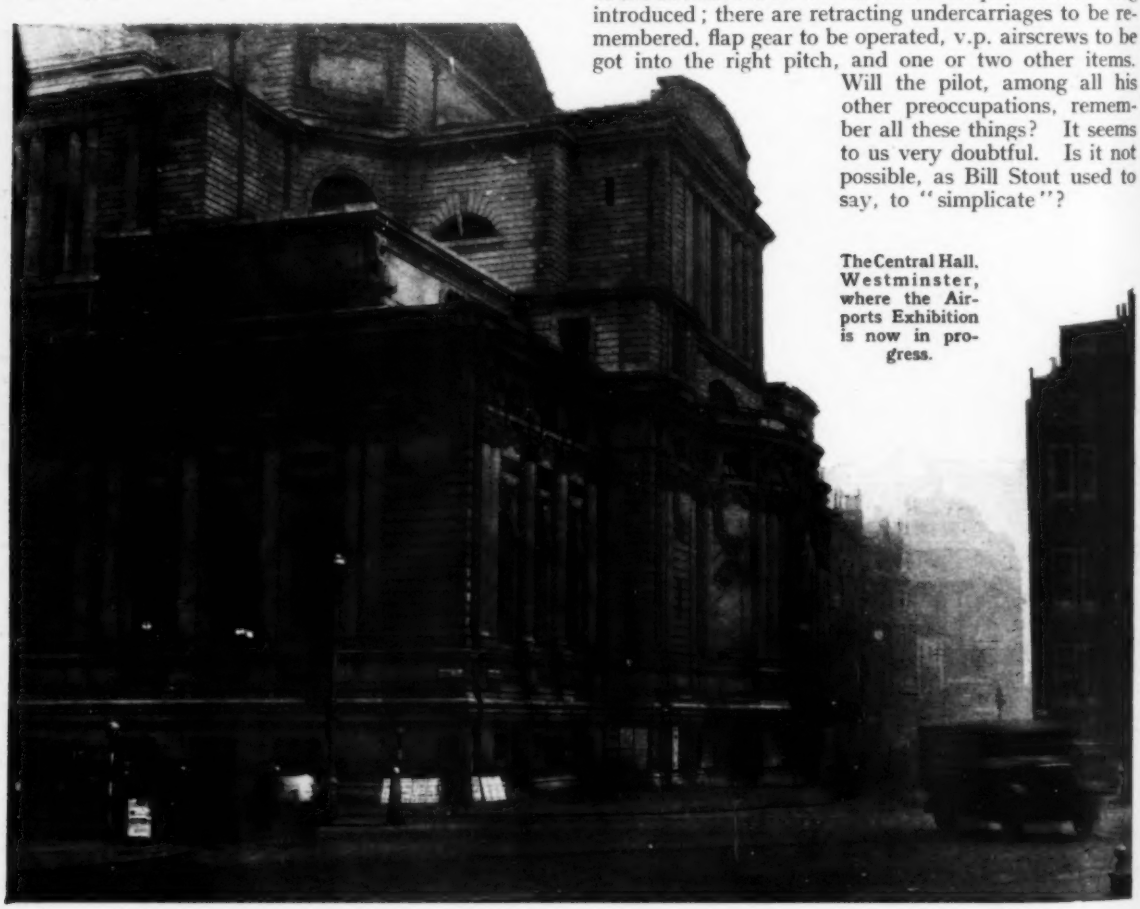
IT is impossible to visit one of our aircraft works nowadays without being appalled by the degree of complication which is gradually creeping into the installation of equipment of military aircraft. If one is examining a single-seater fighter with girder-type fuselage, for example, it is *sometimes* just possible to see, here and there, as through dense undergrowth in a forest, bits of the primary structure. Cylinders, boxes, leads, pipes, and dials are everywhere. Of the aeroplane itself little is to be seen.

Obviously, the duty of a military aeroplane is to carry military equipment aloft, but one cannot help wondering what would happen in the unhappy event of war breaking out. When aircraft designers first turned to metal construction, their main preoccupation was with the primary structure. As *Flight* pointed out several months ago, the primary structure is now of secondary importance from a production point of view, and it is the installation of all the complicated equipment which runs away with the number of man-hours. Therefore, should an emergency arise, the installation of equipment is going to be the bottleneck of production. From that aspect the growing complication is sufficiently disturbing.

There is, however, another side to this subject. In the early years of the war 1914-18 the fighter went off with a gun or two, an A.S.I., a compass, an altimeter and a rev. counter, and, of course, the ammunition for the gun. A single petrol pipe was usually all that connected the petrol tank with the engine, and, although this represented, from one point of view, a great many eggs in one basket, there was the offsetting advantage that the target represented by one petrol pipe was a very small one.

The modern single-seater fighter, with its multiplicity of vulnerable "smalls" scattered over a considerable area, will present a fairly good target. Almost any one of the dozens of leads, connections, and what-nots will, if hit, bring the machine down sooner or later. The thinking observer cannot fail to ask himself whether we are on the right track; whether, should a war break out, one of the first actions would be to remove from many types of aircraft half of the "junk" which they are now condemned to carry.

The unfortunate pilot not only has to carry much more military equipment than formerly, but in the operation of the aircraft itself more and more complication is being introduced; there are retracting undercarriages to be remembered, flap gear to be operated, v.p. airscrews to be got into the right pitch, and one or two other items. Will the pilot, among all his other preoccupations, remember all these things? It seems to us very doubtful. Is it not possible, as Bill Stout used to say, to "simplicate"?



The Central Hall, Westminster, where the Airports Exhibition is now in progress.

The Outlook

A Running Commentary on Air Topics

A Bas Les Chemins de Fer !

GRADUALLY the railway link is being eliminated from the air journey between Great Britain and Egypt. Imperial Airways have doubtless been wise to advance by gradual steps since putting *Canopus*, *Centaurus* and *Castor* into service. The completed plan will be for all passengers and mails to embark at some South Coast port—at present Hythe in Southampton Water is being used, but ultimately the base will be at Portsmouth —and to fly straight to Marseilles and thence to Brindisi before setting out for Rome, Athens and Alexandria. There the two services to Durban and Sydney will diverge, but boats of the Empire class will fly right through to both termini.

On receipt of the first boats of the batch, Imperial Airways first sent mails through by them to Marseilles, and later, also, *Castor* picked up the passengers who had reached that port by train. The passengers now score by having to spend only one night in the train instead of the two nights necessary when they could only embark on flying boats at Brindisi. *Castor* used this "mail only" flight to Marseilles as an opportunity to prove her capabilities by flying right through non-stop, not using either of the refuelling places which have been provided on the Seine and the Saone.

Last week *Centaurus* took a further step forward, for she carried nine passengers through from Hythe to Marseilles (as well as a ton of mails) and on to Alexandria. These passengers had not to use a train at all except to get to Hythe. This was only a trial flight, and until several more boats have been delivered the regular plan will be to go by train to Marseilles; but this is much less wearisome than the rail journey to Brindisi. *Centaurus* and her sisters are far more comfortable than any train.

Encore Batavia-Darwin ?

ONCE again the Dutch have asked for permission to extend their air line from Batavia to Australia, and the Australian Government has consulted the Air Ministry before giving an answer. Every party to the International Air Convention has the right to refuse leave for a regular service by a foreign company to or over its territories. Dutch machines arriving at Darwin would, presumably, link up with some Australian landplane service, and so would short-circuit the route of the Empire class flying boats to Sydney. Conceivably the Commonwealth might use this possibility as a card in its bargaining game with the Home Government, in which it is holding out for a sixpenny surcharge on air letters from Australia to England. It seems, however, that Australian business opinion is not behind the Commonwealth Government in this matter, and a leading Australian paper has said that it would be unconscionably bad faith for Australia to admit the Dutch while itself holding up the agreement with Imperial Airways.

Two Interesting Flights

TWO interesting R.A.F. flights started from England last week. Four London flying boats of No. 201 (F.B.) Squadron, under Sqn. Ldr. J. D. Breakey, D.F.C., left Calshot for the Mediterranean, where they will take part in the spring cruise of the Mediterranean Fleet. Incidentally, it is gratifying to learn that No. 201 Squadron is in possession of London flying boats. The itinerary chosen was *via* Hourtin, Berre, Malta, Algiers, to Gibraltar. The squadron will, however, return *via* Lisbon.

It is some time since a number of flying boats went to sea with a fleet, and probably this cruise will throw some light on the possibilities of useful co-operation between this type of aircraft and the ships. From certain naval quarters complaints have been uttered of late that the Navy ought to have flying boats at its disposal in addition to carrier-borne landplanes and catapult seaplanes. If that is the official view of the Admiralty, the natural course is to indent on the Air Ministry for so many flying boats and to pay for them by an appropriation-in-aid. There are, however, problems to be solved when a flying boat formation goes to sea with a fleet, not the least of which is refuelling in a sea which may not be calm. There were rumours of the Admiralty building "mother ships" for flying boats, but nothing more has been heard.

It is probably with the purpose of examining these and other problems at first hand that the A.O.C.-in-C. Coastal Area, Air Marshal Joubert de la Ferté, is accompanying the Londons on this cruise.

Practising Mobility

THE interest of the second flight is quite different. Twelve Vincents of No. 45 (Bomber) Squadron, which is permanently stationed at Helwan, started from Heliopolis on an inter-Command flight to the North-West Frontier of India, under Wing Commander A. R. Churchman, D.F.C. The route chosen was Amman, Rutbah, Hinaidi, Shaibah, Bahrein, Gwadar, Karachi, Khanpur, Lahore, Risalpur.

The interest of the flight lies in the transport of a number of non-flying personnel and stores of the squadron in bomber-transport machines which accompany the flight. For the first stage from Heliopolis to Hinaidi (or, in other words, from Cairo to Baghdad) the transport was provided by three machines provided by No. 216 (B.T.) Squadron. At Hinaidi No. 70 (B.T.) Squadron took up the running and sent five Valentias on with the bombers to Risalpur.

There has been discussion of late in Service circles, and especially in the columns of the *Royal Air Force Quarterly*, as to the degree of mobility which the R.A.F. can justly claim. Naturally, if a squadron can only move its aircraft and its flying personnel with a few spares tucked away in the cockpits, its utility on arriving at its destination is limited. When aircraftsmen and spares in sufficient quantities are taken along in transport machines, the squadron is likely to arrive fit for any job.

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VITAL CO-OPERATION

Airport and Area Control Methods Developed During the Past Decade : The Need for Rationalisation

Illustrated with *Flight* Photographs

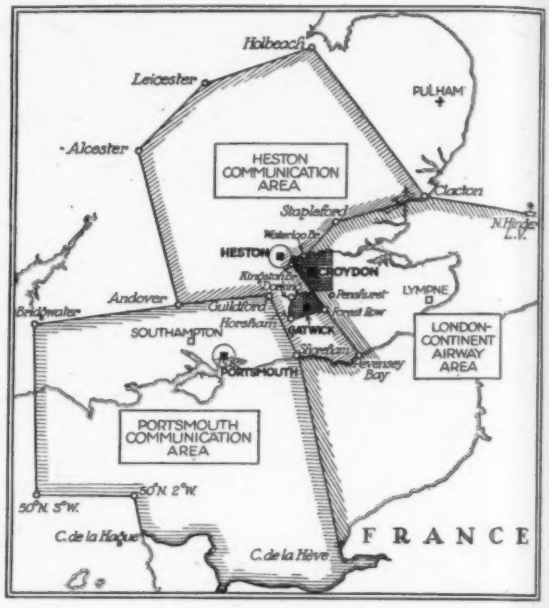
By H. A. TAYLOR

AT this very moment, when we are waiting almost daily for the appearance of the Maybury Committee's report and when the majority of people intimately connected with airport control are expecting to learn of fairly drastic changes in the system, an article on air line control systems is perhaps somewhat premature. Nevertheless, this particular issue is designed largely for the benefit of those who are interested in the whole business of airports and their operation, and it would be incomplete if this vital aspect of the matter remained untouched.

Fortunately, it would seem that the main principles will not be altered. At a guess one would say that the greatest need is for a central "signal box." Whether this "box" is at the Air Ministry, in a bomb- and soundproof shelter at Tooting, or in a house at Bexhill, is a matter of small importance so long as the system of communication with the various airports is beyond reproach and so long as Control Officer No. 1 can work uninterrupted.

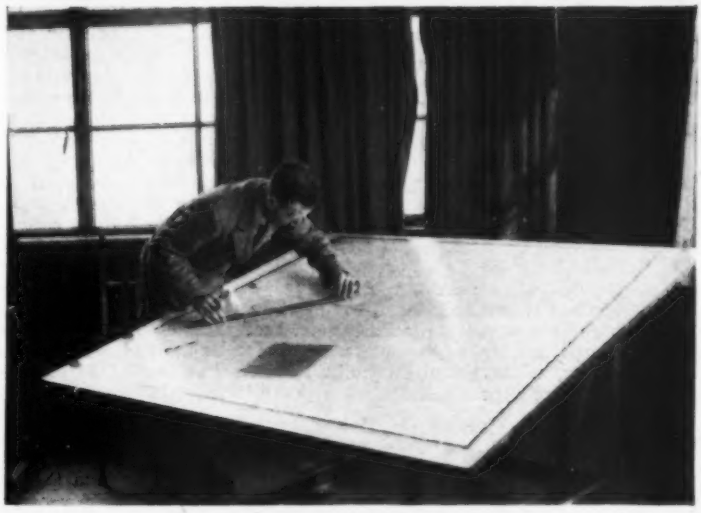
Only in this way can the movements of aircraft be accurately followed and planned. Only so can the control officers at each busy airport be free to deal with the immediate and practical details of the final approach and landing of a dozen machines in conditions of poor visibility or low cloud. At present these control officers, though harassed by the thousand and one matters requiring immediate attention, must still keep track of the various machines which are, in fact, well outside the airport zone. Any form of rationalisation which will relieve the airport officers' responsibilities will be more than welcome, both to them and to the pilots who are dependent on them for the safety of their passengers.

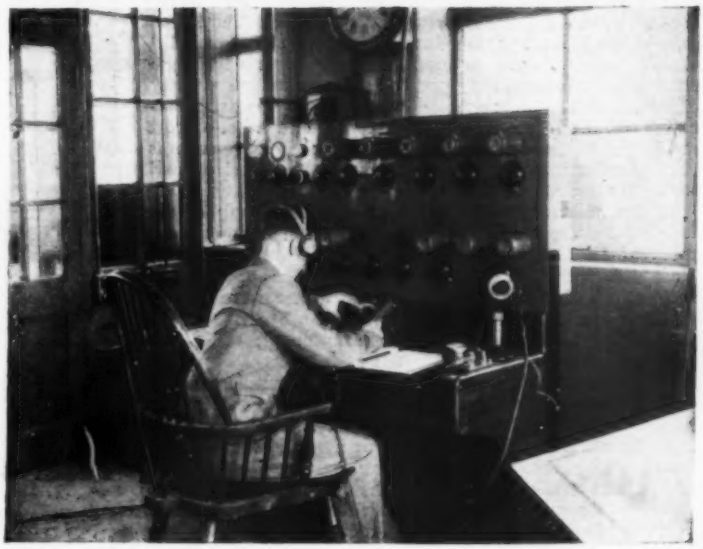
Further, the system as it stands at present has been built up very largely by the individual control officers, each of whom has a vast experience on which to draw, and success of operation depends



The communication areas and controlled zones as they appear at present. Croydon, it will be noticed, is almost exclusively concerned with Continental traffic, while the nearby airport of Gatwick is under Heston's control.

In Gatwick's recently constructed airport building it might be expected that the all-round view from the control room would be perfect. Above, the chief officer, Mr. Simmonds, is seen at his desk. On his left is the position chart, while in front of him are the airport lighting switches. Among the business-like array of telephones two are for direct land-line communication with Heston and Croydon. On the right is the short-range D/F equipment at Gatwick. When this photograph was taken a British Airways' D.H.86 was being brought in on bearings, and one of the company's latest acquisitions, a Junkers 52, was being tried out, in and above the prevailing low clouds.





Keeping track at Croydon. In the top picture Mr. Emerson marshals the position flags on the chart in the control office. (Centre) "Position please!" At work on the D/F board at Croydon. Pulham and Lympne are the other two stations used in plotting a "fix." (Lower picture) The short-range controlled-zone D/F set at Croydon. This is used only when communicating with machines coming in during QBI conditions.

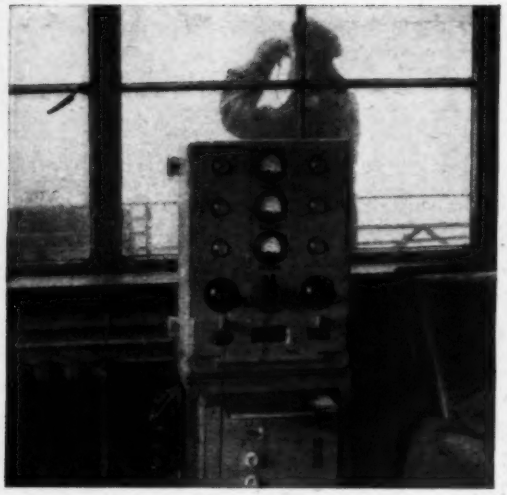
very largely on their own initiative. With new blood coming in all the time it is obviously necessary for the system to be more automatic and mistake-proof. Hence my use of the expression "signal box."

After this apologia let us return to the control system as it is at present. Described briefly, the country is divided into certain sections, known as Communication Areas, each with its central control. These areas are further reduced to what are known as Controlled Zones surrounding certain busier airports. In conditions of poor visibility no machine may enter these zones without permission from the central control and, permission being difficult to obtain without radio, this rule virtually prohibits radioless machines—for the safety of all concerned. These bad-weather conditions apply when visibility is less than 1,000 yd. horizontally and less than 1,000ft. vertically, and carry the now well-known code group QBI. In good weather a machine's course and height are left to the pilot's discretion; in bad weather the central control must have a check on all machines in order to prevent the possibility of collision, and must be particularly careful about machines which have been given permission to enter a zone.

Safety Zones

Ten years ago the Croydon control handled the whole of the airline traffic of this country, and the area system has developed quite naturally as more radio stations appeared and as the volume of traffic, and, consequently, of radio messages, increased. The present areas and zones in South-East England are shown in the sketch map on page 50. In addition, all airport radio stations, apart from those at Gatwick and Croydon, whose zones are defined in detail, are now considered as having their own prohibited areas, enclosed within a cylinder with a radius of five miles and a depth of 2,000ft. In other words, when visibility is poor no machine may, without permission, approach within five miles of a key airport unless at more than 2,000ft.

Within the last year several short-range direction-finding or D/F stations have been erected, and their duties are confined to any necessary communication with machines flying within a certain distance of the airport concerned and to the job of bringing these machines in, if necessary, on consecutive radio bearings. For instance, a pilot flying between Jersey and Southampton would, after entering the Portsmouth area, obtain bearings from, and report to, the Portsmouth station until told to communicate with Southampton. A pilot flying from Birmingham to Gatwick would deal with Heston until given permission to enter the Gatwick zone and change over to the Gatwick station's frequency. A pilot taking off from Gatwick would normally tune in to



Croydon's first ultra-short wave approach and marker beacons have now been in action for some time. On the left is the control panel which also indicates whether the three transmitters are working properly. (Right) "You may take off!" The look-out man at Croydon gives the take-off signal with the fixed signalling lamp on the control-tower gallery.

Heston at once in order to report departure, destination and height. The short-range stations are, in fact, auxiliary stations for the benefit of pilots coming in to the airports on which they are placed and for the purpose of relieving the main station in the area concerned.

All the existing control methods are based on that developed at Croydon, and a brief description of the work there will apply to that at the others. Radio being the all-important medium of control, it should be explained, first of all, that, apart from those used for meteorological and other messages, there are three separate sets. One is used for telephony (in little demand nowadays), another for telegraphy and a third for short-range bad-weather work. The last is used only for communication with those machines already in the controlled zone, whose pilots are preparing to land. In addition, there is the ultra-short wave repeater, which shows the control officer that the main and marker approach beacons are doing their work.

Communications

The principles of, and possible developments in, radio equipment are dealt with by Mr. Roderick Denman elsewhere in this issue, and it is sufficient to explain that the long- and short-range D/F receivers have their aerials necessarily on the control tower itself, while the transmitters work through the Mitcham station; it would obviously be dangerous to erect the tall masts which are necessary for transmitting power in the immediate vicinity of the airport. Teleprinter and normal land-line communication is used for inter-departmental and inter-airport messages, while the familiar pneumatic message-tube is used for the internal transport of written or teleprinted slips, all of which are filed for reference if necessary.

In the main control office there is a large map of the London-Continent area, and the officer in charge keeps track of all the machines within this area by means of pins with identification flags—the direction of the flag showing whether a machine is outward- or inward-bound. All messages to and from the machines are handed to the officer, who moves the pins accordingly, or by his own estimation of progress.

In poor visibility, for reasons of mental comfort and for the very necessary estimation of arrival time, a pilot always likes to obtain a check on his dead-reckoning. Bearings are taken on him at a particular moment by Croydon, Lympne and Pulham, and these bearings are laid out on a special chart in the operators' room. The point of bearing intersection—which is almost invariably a small triangle, known as a "cocked hat"—gives the position of the machine at the moment when the bearings were taken. A position, or "fix," can be provided within a minute and a half of request, and as many as five plain bearings can be taken and transmitted within the same period of time. Once the pilot has been given permission to land during bad weather, he is led in on these bearings—given, in this case, by the short-range operator—and, if his machine has the necessary equipment, he makes his final approach down the short-wave beam. Eventually, two approach beacons will probably be in use at Croydon, transmitting in different directions, making it possible to complete a landing in other than calm conditions almost straight off the glide path and without circling.

At a busy airport some simple form of departure procedure is vitally necessary. At Croydon the pilot of an airline machine is given permission to leave the tarmac by the display of a panel, bearing an appropriate letter, on the control tower gallery. This means that the "ship's papers" are in order and that movement can safely be made. When the pilot reaches the take-off point he awaits a further signal, consisting of a white light projected from the tower by means of an Aldis lamp. This signal is necessary in order that the look-out man may see, before the take-off run is started, that no other machine is coming in. Once in the air, the radio operator runs out the trailing aerial and tests his set.

Croydon's chief: Air Commodore E. D. M. Robertson, D.F.C., the chief officer at our premier airport.

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS

EMPIRE AIR DAY this year will be Saturday, May 29. Service and civil aerodromes will be open to the public.

The R.A.F. Benevolent Fund has already benefited by £14,000 as the result of previous Empire Air Days.

German airships on the North Atlantic service paid £12,000 in landing fees to the U.S. Navy last year.

It is reported that sixteen long-range heavy bombers have been ordered from the Fokker Company by the Dutch Government.

With Government approval Egyptian students have been raising money to form three squadrons for the Egyptian Air Force.

Numerous gifts have been received from private individuals and the Cabinet and leading Government officials have devoted one month's salary to the cause. Over £1,000,000 has been collected.

The Vultee monoplane, *Lady Peace*, used by Richman and Merrill for their double Atlantic crossing has been sold to the Spanish Loyalist Government.

A total of 550 Taylor Cubs were made and sold during 1936. Capt. Frank Hawks was but one of the professional pilots who acquired Cubs.

The four-engined Latécoère flying boats of the type in which Mermoz was lost during a South Atlantic crossing last month are to be taken out of service for examination.

Owing to the space in this special issue devoted to airports and allied subjects, it has not been possible to include an account of the paper on Magnesium Alloys read by Professor Desch before the R.Ae.S. last Thursday. The paper will be dealt with in next week's issue.

SMALLER ARENAS? The production-type Gloster Gladiator single-seater fighter (795/825 h.p. Bristol Mercury IX) has flaps on upper and lower wings and an enclosed cockpit. The maximum speed is 255 m.p.h. at 14,500 ft.

Mr. and Mrs. Martin Johnson, the explorers who have used aircraft so extensively on their expeditions, were in an aeroplane crash in America last week. Mr. Johnson was killed.

F/O David Llewellyn hopes to leave Croydon for the Cape at 9 a.m. on Sunday the 24th and to be back again on the following Thursday. He will use a Percival Vega Gull.

Viscount Swinton will be the principal guest at the annual dinner of the A.I.D. to be held at Grosvenor House on Friday, February 12, under the chairmanship of Mr. A. McIsaac.

The D.H. Comet (2 Gipsy Six R) which, flown by Scott and Black won the MacRobertson England-Australia Race in 1934 is up for sale at Mr. L. Lipton's emporium in Old Ford Road. It will probably be rebuilt and flown in the New York-Paris race, for which four or five machines are already being prepared.

Caudron has completed a light fighter monoplane known as the C.710 or Requin fitted with a 450 h.p. Renault inverted vee twelve-cylinder engine. It should be capable of over 300 m.p.h.

Gas-proof stretchers, fitted for the administration of oxygen while the patient is being removed from the scene of his injury, are being added to the equipment of the Monospar ambulance *Florence Nightingale*.

The 1937 plan of the Soviet Civil Aviation fleet provides for the opening of 1,550 miles of new airways in Russia. It is estimated that its machines will carry 180,000 passengers, 44,200 tons of freight and mail and scatter insecticides over 12½ million acres.

All airways are to be equipped with radio beacons and other modern facilities and new aircraft, including the ten-passenger ANT-35, which cruises at 220 m.p.h. and the twelve-passenger ZIG-1 (cruising speed 180 m.p.h.) will be operating on the Moscow-Novosibirsk-Irkutsk, Moscow-Baku and Moscow-Simferopol lines.

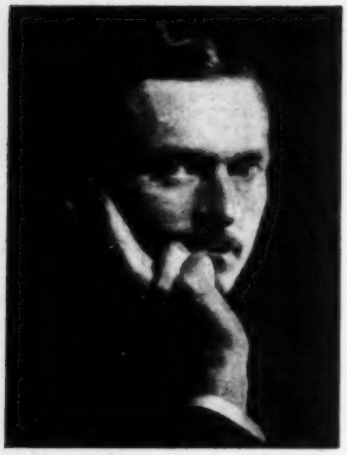
Negotiations for the proposed merger of Westland Aircraft, British Marine Aircraft, the British Aircraft Manufacturing Co., General Aircraft and Aero Engines have been broken off, it not having been found possible to arrange terms suitable to all.

CIVIL EXPANSION: Speedy progress is being made with the reconstruction of Le Bourget, the airport of Paris. This view shows the control tower of the new building. The aircraft is an Air France Potez 62 with Gnôme-Rhone K.14s.

Twenty-five Years Ago

(From "Flight" of January 20, 1912.)

"It is a significant indication of the progress that aviation is making, that the British and Colonial Aeroplane Co., has just had to increase its capital from £50,000 to £100,000 . . . To us it seems a most encouraging feature of the rapid development of the science and an earnest that at last we are on the eve of seeing established a real industry in these islands, comparable at least to that which has been built up with the assistance of the State in France."



The author of this article.

RADIO AIR NAVIGATION

The Trend of British Development

By RODERICK DENMAN, M.A., A.M.I.R.E., A.F.R.Ae.S.

A WELL-KNOWN indoor game assigns to unknown pairs of players the name of some animal, requiring that the male and female of each species identify themselves one to another by means of their characteristic utterance. In the general hubbub that ensues the prize is awarded to the pair who first succeed in recognising each other's cry.

While it is on such lines that British aeronautical radio communication has necessarily to be conducted at the present time, the possibilities of selective reception are even scantier than have been suggested in the example given above. The actual conditions are fairly closely identifiable with those of the parrot house at the Zoo.

This lack of clear channels for communication and direction-finding purposes arises from the nature of wireless itself, and from the inability of the early pioneers either to foresee or to make adequate provision for the growth of radio aids to aviation. To-day, as is well known, we have barely sufficient wavelengths with which to maintain the present European system of direction-finding by ground stations. This system is evidently wasteful in so far as it can be replaced by aircraft observations on radio beacons, but is important for traffic control operations and (at present) unique in respect of its immunity from night error. We may therefore expect to see shortly not the abandonment of the elaborate D.F. network which now covers Europe, but the beginnings of an auxiliary beacon system which will enable pilots to locate themselves without transmitting requests for a bearing or position. This might be done in several ways, some less economical than others. Medium-wave navigational beacons ("radio ranges"), as used in America, for instance, would require more wavelengths than we can hope to provide, having regard to the number of air routes flown. A more efficient plan is to have triangular groups of medium-wave stations possessing omni-directional characteristics. In this system, which is borrowed from marine practice, all three stations in a group work on a shared frequency, and each in its turn for a period of two minutes, thus forming a total cycle of six minutes per triangle. The conference of aeronautical radio experts which met in Paris last June decided to proceed on these lines, and contemplated the following as initial triangles:—

Oslo	Stockholm	Copenhagen
Königsberg	Breslau	Hamburg
Amsterdam	Paris	London
Hanover	Stuttgart	Brussels
Berlin	Munich	Cologne
Warsaw	Vienna	Prague
Zurich	Genoa	Lyons
Milan	Venice	Rome
Toulouse	Marseilles	Barcelona
Belgrade	Bucharest	Sofia
Madrid	Palma	Seville
Naples	Syracuse	Elmas
Brindisi	Benghazi	Tripoli

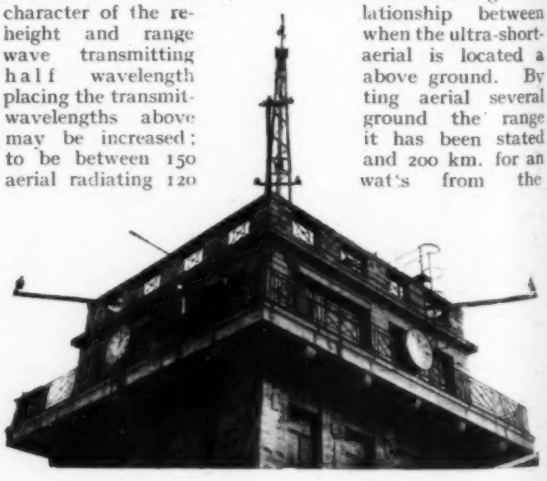
With the object of minimising night effect, the frequencies were to be kept as low as possible. However, it is not going to be easy to find enough of these.

It is probable that the existing type of aircraft direction finder will in due course be superseded by a form of cathode-ray direction finder, giving rapid and automatic bearing indications. Not only has one such device already been tested in America, but the subject is one in which British radio engineers have taken a leading part. It is important to realise the extreme rapidity with which bearings can be taken by means of the cathode-ray direction finder. The signal need not last longer than a few milliseconds, consequently we have a large potential increase in the handling capacity of existing ground D.F. stations. Very rapid position finding is performed by one European group of stations where cathode-ray direction finders are already in use, but the necessity for collecting and signalling the results from the co-operating stations brings the operating speed far below the theoretical limit. Bearings are therefore to be preferred, and are growing rapidly in number. In Great Britain in 1932 the proportion of bearings to fixes was 2 to 1; in 1936 it was 55 to 1. The total number of fixes in 1932, with three stations in operation, was 1,032. In 1936, with 25 D.F. sets working, it was only 988, or less than one per station per week.

Ultra-Short-Wave Beacons

Although the wavelength shortage precludes the use of medium-wave navigational beacons on a large scale in England this is not necessarily true of the ultra-short-wave type of beacon. Of such are the Lorenz, Telefunken, Marconi and Plessey-R.T.E. beacons. Their characteristics are now fairly well known. At any given distance there is a large increase in signal strength with height, the useful range (at the lowest height of an approaching aircraft) being in the neighbourhood of 30 km. The question then arises as to the range of such beacons to aeroplanes flying at greater distances and greater heights.

The diagram of Fig. 1, while only accurate for a particular set of conditions, will serve to indicate the general character of the relationship between height and range when the ultra-short-wave transmitting aerial is located a half wavelength above ground. By placing the transmitting aerial several wavelengths above ground the range may be increased; it has been stated to be between 150 and 200 km. for an aerial radiating 120 watts from the



summit of a tower 40 metres in height, the receiver being in an aeroplane 3,000 metres above ground. Ranges of this order have even been reported by British commercial machines using the normal approach beacon at Hamburg, but they may have been due to some local conditions. At all events, it seems safe to declare that in order to obtain consistent ranges of 100 miles or more it would be essential to fly at heights in excess of 6,000 feet. While this may not be altogether convenient, we are bound to take note of it as a possible necessity imposed by the congested state of the ether, just as slower road speeds have been forced on us by traffic congestion. Should we fail to develop a complete solution of the de-icing problem the pilot might find it impossible, on some occasions, to ascend to a level of adequate signal strength. In that case he would either have to proceed by dead reckoning until he came within range of the beacon for the particular height at which he was ably to fly, or alternatively to employ medium-wave direction-finding methods.

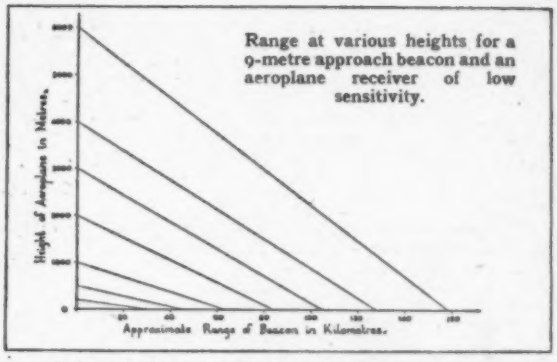
Whether the ultra-short-wave beacon is actually brought into use in England for long-range navigational purposes as distinct from its use for approach and landing, will again depend on the question of the availability of sufficient wavelengths. Happily in this case the claims of the air are being dealt with alongside those of other interests, and they are therefore assured of a fair hearing. But until technique is improved there will not be room for a strikingly large number of ultra-short wavelengths, and the utmost economy will have to be exercised. If it is decided to lay down a system of ultra-short-wave track beacons it will be necessary to choose between beacons with simple, elevated, aerial systems giving maximum range, but also a wide area of interference, and the more complicated arrays which, because they must be built at ground level, give a shorter range while confining the area of interference within much narrower limits.

Re-Radiation

Direction-finding on ultra-short wavelengths does not seem at all promising, at any rate on board an aircraft. The whole structure of the machine is illuminated (in an electrical sense) by the received rays. Each part, being of a size comparable with the wavelength, can and would re-radiate the signal with a completely bewildering effect on a tuned loop or other directional receiving aerial. Nevertheless, the ultra-short wave track beacon fails to solve the problem of the itinerant aircraft not flying over a regular route. It is therefore attractive (if somewhat fanciful) to imagine a "radio grid" which would cover the British Isles and provide instant position indications by means of a system of rectangular or polar co-ordinates. The Dutch firm of Philips has actually produced small omnidirectional beacons, modulated by sound films and intended for broadcasting the name of a town or aerodrome over a limited area. It was suggested that such beacons might be established at short distances apart over an entire country and used by aircraft for localising their position. As bearings could not be taken on them, their power and number would have to be adjusted to give the required degree of "definition" to the grid.

For example, if it were decided to give each beacon a ten-mile radius of action, it would require 300 beacons to cover Great Britain. In practice, the service areas would increase with height, and there would be a certain amount of overlap, but this objection could be countered by running the sound tracks in synchronism from controlled mains, and staggering them to prevent simultaneous emission of place-names within a given area.

In this way a pilot flying at 5,000 feet might hear as many as five different beacons repeating five place names in succession. Descending to 3,000 feet he might find three only, and of these he would hear one more loudly than the others. At 1,500 feet a single beacon would normally be heard. An additional sound track, giving brief coded weather information, could perhaps be switched into circuit by the attendant, the mechanism for this purpose being similar to that of the Post Office talking clock.


Range at various heights for a 9-metre approach beacon and an aeroplane receiver of low sensitivity.
Height of Aeroplane in Metres.
Approximate Range of Beacon in Kilometres.

Evidently the idea has some merit. But it is to be feared that in practice there would be too many difficulties, and it is not here put forward as a serious proposal. Non-uniform attenuation would distort the polar diagrams, making it extremely difficult to adjust the power of the beacons for satisfactory coverage. Then it is difficult to see how, on ultra-short wavelengths, the frequency could be sufficiently well stabilised to permit single wavelength working without heterodyne interference. Of course, the carriers could be suppressed while the beacons were silent, but as there are still many places without A.C. mains timed emissions could not be made universal. However, we shall probably be using the omnidirectional ultra-short wave beacon as a route-marker before long, if for no other purpose.

All things considered, it appears probable that the navigational needs of commercial flying in Great Britain (which may not take so very long to reach saturation level) will mainly continue to be supplied by medium-wave direction-finding, speeded up by cathode-ray methods, reinforced by aircraft D/F. bearings on ground stations and relieved as necessary by the transfer of purely communication channels to shorter wavebands.

Private Flying

As for private flying, this will probably continue to be regarded as a more or less risky sport, only an occasional owner possessing the skill and determination to constitute himself a one-man airline crew, and (while flying blind) to read and send Morse at over twenty words a minute. Such men will never congest the ether, for they are too scarce. All other private owners will have to fly low, with or without the help of D.F. compass bearings on medium-wave stations. They will not be able to keep their machines at airline terminals unless they are prepared to beg for admittance on foggy days.

In seeking such permission, they could (1) land and make enquiries; (2) congregate dangerously in the sky over a ground panel; or (3) employ ultra-short-wave communication equipment. Should a sufficient number of them find it worth while to seek facilities for (3) it is probable that most airports would be willing to subsidise a low-power station for their benefit, but the segregation of aircraft into groups on different wavelengths tends to remove the inevitable bottle-neck from the wireless station to the control tower.

A penetrating analysis of the functions of wireless for control and for navigation purposes has been furnished by the head of Civil Aviation Signals, Mr. W. A. Duncan, who, in commenting on the present article, made the following observations:—

"The most important of recent developments is the superposition of 'control" communication on to the original 'navigational' communication. Both being carried out by two-way radio, a saturation point is easily reached at which neither the control nor the navigational functions of radio can be sufficiently rapid to respond to the speed of aircraft.

"Such a saturation point is common to all systems for two-way communication—and is not intrinsically a radio matter.

The cause not lying in the field of radio, the cure will not be found there either—so long as two-way working has to be employed.

"So far as control is concerned, there is at present no alternative to two-way communication; i.e., no direct method (e.g., anti-collision device) is in sight. The alternative is therefore to plan the air traffic organisation so that it is not compelled to rely almost exclusively on radio for anti-collision protection (flight-paths, altitudes, spaced departures, etc.).

"Navigation, on the other hand, can already in part be transferred to direct action in the aircraft (homing, ultra-short-wave beacons, etc.). Homing, in particular, can be used simultaneously by large numbers of aircraft, without the delays inseparable from two-way working.

"Also, it can make use of existing radio services, broadcasting, etc., and so does not involve too many additional wave-channels. The transfer of navigation to the aircraft frees the ground stations for control functions."

Mr. Duncan illustrated the above statement with figures showing how moderate air traffic congestion begets worse radio traffic congestion. Thus, a rise of 45 per cent. in the number of aircraft worked annually was accompanied by a 75 per cent. increase in radio traffic; "control" messages now outnumber all others by three to one. Some of these could probably be dispensed with, for Mr. Duncan has observed that messages from air to ground are seventeen times more numerous than those from ground to air. Clearly, we should now be approaching an *impasse* were not several European airline companies, by demonstrating that very accurate bearings can be taken from machines in flight, already pointing the way out.

In the matter of blind landing, it is a startling fact that the approach beacons in this country actually outnumber the aircraft that have so far been equipped to receive them. It has, in fact, taken a long time to make up for past indolence in regard to the screening of engines, and until quite recently there was no effective co-ordination between the manufacturers of aeroplanes, radio and ignition equipment respectively. Gradually this is being overcome. At the request of British Airways, the Marconi Company have evolved a promising screening harness for the Gipsy engine, and this is now undergoing its type tests at Stag Lane. Integrally screened plugs are at last becoming generally available, and ozone-proof high-tension cables complete the modern armoury against ignition interference.

Our experience of ultra-short-wave approach and marker beacons is so slight that it is premature to attempt to define their limitations. Neither at Gatwick nor Croydon, nor even at Heston, can the present layout be said to constitute an instrument landing system, for which an extremely good runway and approach is necessary. A visual homing device would greatly assist in setting the gyro when following a track beacon, and is being tried in America, where the extra wavelength required presents no difficulty.

Auxiliary ground lighting is essential. There is scope for discussion on the best layout, but two lines of lights are probably better than one, since the latter fails to give any information at all regarding the orientation of the plane wherein it lies. The lights should extend for perhaps 1,000 yards beyond the boundary of the airport, and should be differentiated at certain points by colour variation. In America it has been reported that a system of 10-foot neon tubes, arranged at 100-foot intervals and extending 800 yards beyond the runway, was found to provide an excellent approach system. It was to be supplemented by a double line of lights spaced 200 feet apart across the airport.

To say that visual assistance should be at hand towards the end of a blind approach is not to decry the work of the radio engineer, who has successfully guided the pilot's hand in many hundreds of otherwise unassisted landings. But unless and until the landing process is completely mechanised (as has been accomplished, for example, in the domestic elevator by the invention of automatic floor levelling) it will obviously be prudent to relieve the pilot of the necessity for making mental transcriptions during the last moments of his descent. As his experience grows, he will probably require to make less use of the lights. But without their aid he will never discover the final limitations of the glide path.

A ROYAL AERONAUTICAL SOCIETY CONVERSAZIONE

SOME films of outstanding interest, shown by courtesy of the Air Ministry, were the *pièce de résistance* at the conversazione held at South Kensington Museum last week by the Royal Aeronautical Society. Some of the visitors to the conversazione—members and their guests to the number of about 400—had seen a portion of the films before, on the occasion of the annual visit to the National Physical Laboratory at Teddington last summer. In the main, however, they had not been shown before and they had a very well-deserved reception.

First was shown a film taken at the Royal Aircraft Establishment showing a model in the vertical spinning tunnel, in slow motion and then at normal spinning speed. Next came a film showing the Parnall monoplane in the Royal Aircraft Establishment's full-size wind tunnel. This was followed by views in the R.A.E. water tank, in which a porpoising model caused particular amusement by jumping completely out of the water.

The airflow film taken at a speed of 2,300 pictures per second was the part that had been shown at the N.P.L., but was none the less interesting on that account. In making a film of this kind the flow is made visual by discharging a series of sparks into the airstream. These travel downstream with the air and flow over the model which is being photographed, thus clearly indicating the airflow.

The slow-motion film of seagulls was extraordinarily pretty, but most amazing, perhaps, was that which illustrated a pigeon being released from the hands of the man. The manner in which the pigeon's wings met above and below the body during their violent beating was extraordinary, and few had realised that such big movements take place in bird flight.

Extremely interesting was the slow-motion film of a humming-bird. This film was taken at the rate of 1,000 pictures per second, and one was easily able to follow the movements made by the bird's wings. This movement appeared similar to that made by the arms of a man floating on the surface of the water and just keeping himself afloat by a slow movement to and fro of the arms, accompanied by a twisting of the hands to alter the angle of incidence.

The commentator was Mr. R. P. Alston of the Royal Aircraft Establishment at Farnborough. Mr. Alston's commentary was just exactly the right sort, sufficiently non-technical to be of interest to the ladies present and to others not highly technically trained, and yet it was sufficiently technical to interest those with a deeper knowledge of the subject.

The conversazione must be written down an unqualified success and it is to be hoped that many similar functions will be held in years to come. The fact that there was no Wilbur Wright lecture to be read this year was probably rather welcomed than otherwise, as it is not everyone who wishes to combine a social function with a lecture which is sometimes of a highly technical character.

Warmth with Safety

AS everybody knows, the danger of fire (or, at any rate, its potentiality for destruction) is more serious in the case of aircraft and aircraft hangars than in most others. An exception might be quoted, namely, that of the petrol-carrying barge, upon which even cooking and heating arrangements were forbidden by Government regulations until recently, when a safe method of heating was developed.

Air Ministry and other experts last week attended a demonstration of that method, actually a new stove developed by Aladdin Industries, Ltd., of Greenford, Middlesex. It is guaranteed to be absolutely safe, and should therefore be very suitable for heating hangars and for keeping engines warm.

In the test, for which there is an N.P.L. safety report, the heater was placed in a petrol-impregnated atmosphere, was upset, and had petrol poured over it. In no case was any harm done.

COMMERCIAL AVIATION

— AIRLINES — AIRPORTS —

THE SINCEREST FORM OF FLATTERY: Remembering the success with which D.L.H. have operated their regular night mail service between Berlin and Croydon, it is not surprising that British Airways have acquired two Junkers Ju. 52 machines for their Continental night mail. These were originally ordered by A. B. Aerotransport and have P. and W. Wasp engines—with Hamilton v.p. airscrews—in place of the more normal B.M.W. Hornets. The first British Ju. 52 is seen here taxying out at Gatwick for its initial test flight with Mr. Campbell-Orde, the company's operational manager, on board. (*Flight* photograph.)

THE WEEK AT CROYDON

Expansion : Petition : Investigation : Co-operation : Persuasion

I AM very glad to say that M. Bouderie, the Croydon manager of Air France, who underwent an operation last week, is progressing extremely favourably. M. Bouderie is one of the very senior managers in England and, before Croydon existed, he represented French aviation interests at Hounslow. During his absence, which may still last as long as a couple of months, Mr. Daubigny will be in charge at Croydon.

Residents in the neighbourhood of the Airport, notably those living in or near Hillcrest Road, have apparently got up, signed and had printed a "monster petition" which will no doubt go down in history as an example of prejudice against commercial aviation. The good villagers around the airport state, quite amazingly, that foreign aircraft are not under such good control as British, a statement which is neither polite nor accurate. The apt quotation regarding this document seems to be that in it "the rude forefathers of the hamlet lie."

Rollason Aircraft Services is expanding rapidly and I hear that Mr. John Kenworthy has joined the firm. Mr. Kenworthy, who will be in charge of the Detail Section (Air Ministry contracts) is an Associate Fellow of the Royal Aeronautical Society and, incidentally, a B.Sc. Another pioneer member of the aeronautical fraternity, he was at the old Royal Aircraft Factory, Farnborough, as early as 1911, since when, some people would have us believe, no particular progress has been made there—though I can hardly believe it myself.

Last week, to my regret, I said that Mr. E. J. Hill was employed by Wrightways, but this is not now the case. Mr. Hill flies for Mr. E. G. H. Forsyth, owner of a Miles Falcon which is equipped with two-way radio and Sperry instruments. Incidentally, the machine may be hired at any time for any sort of special charter work.

Last Sunday Capt. Youell, flying a special D.H.86, left Croydon for Berlin with four senior R.A.F. officers, Air Vice-Marshal C. L. Courtney, Air-Comdre. D. C. S. Evill, Wing-Cdr. M. Moore, and Wing-Cdr. R. V. Goddard. This is the first official British mission to Germany, at the invitation of General Goering, to inspect the new German Air Force. It seems typically British that they left in plain clothes, and one wonders if they had uniforms with them. The Air Force uniform, since they took away the black field boots and issued that depressing little cap which nobody appears to know how to wear smartly, is indeed dowdy, but in Germany, of all places, uniforms should be worn, and worn with an air. Anyway, these officers are to see all that may be seen in the skies, on the earth, and, perhaps, under the earth as well.

Swiss Charters

Capt. "Bill" Ledlie, popular chief of Personal Air Services, has arranged for occasional special charter flights between Zurich and St. Moritz, I am informed. D.H. Rapides will be used and a landing will be made at St. Moritz on the frozen lake. This seems to be an example of cordial co-operation between countries, for normally a British enterprise would need to have one terminal on British soil. In this case Swissair machines will link London and Zurich with the normal service, and it appears that Herr Mittelholzer, the famous flying director of Swissair, is sponsoring the idea. An experimental flight was made last week with Herr Mittelholzer as a passenger in the Rapide. The distance is about ninety miles, I believe, and the flight takes about half an hour, as against about six hours by surface transport.

Irish Sea Airways' London-Dublin service is steadily winning popularity by its speed and regularity. Enthusiasm takes much the same practical form as it did ten or

Commercial Aviation

twelve years ago on the London-Paris route. Pilots are offered tips varying from one shilling to five pounds and grateful passengers send them presents varying from a brace of grouse to a gold pencil.

Just before or just after the International at Twickenham I saw the indefatigable "Joe" Chamberlain, of Surrey Flying Services, with some twenty-eight or thirty apparently mesmerised Rugger fans. It seems that they were the Plymouth contingent and amongst them were two ex-internationals, Messrs. Sparkes and Hanley. Needless to say, almost the whole party made a joy flight with Capt. Hancock under "Joe's" eagle eye. A. VIATOR.

Preparations at Karachi

IN addition to the aerodrome improvements at Karachi, plans and estimates for the construction of a flying-boat landing base and the necessary buildings have been completed, and the final touches will be given shortly in the course of discussions between the Port Trust and an official from Delhi.

It is anticipated that the first flying-boats will land at the Keamari seaplane base in October.

Windfalls at Weston

DURING the first six months of Weston Airport's existence no fewer than 18,738 fare-paying passengers passed through—which makes one of the busiest provincial centres in this country.

Even in the winter months the traffic is satisfactory, and during the Christmas holidays most of the Weston Airways' Services were triplicated and run on a half-hourly schedule instead of five times daily as usual in the winter.

Galway's Aerodrome

A CONJOINT air committee has been formed in Galway, Irish Free State, with a view to establishing an aerodrome which will fulfil the conditions required by the Minister for Industry and Commerce and by the Army Air Corps. Some time ago the Minister refused to license the existing aerodrome, which was not considered suitable for commercial flying. A scheme has now been approved by the committee for the laying-out of a full-size aerodrome, which, in its initial stages, will cost about £6,000.

India and the Empire Mails

AT the annual sitting of the Associated Chambers of Commerce in Calcutta, Mr. L. A. Halsall, of the Bombay Chamber, moved a resolution concerning the Empire air mail scheme.

This resolution urged the early acceptance of the proposals and the necessity of making arrangements to ensure that the benefits of the Empire air mail scheme be extended to centres in India not on the through trunk route. Mr. Halsall declared that the value which the public placed upon these services was reflected in the growing use of the air mail.

Australia–New Guinea

TENDERS have been called in Australia for a subsidised air service between Australia and New Guinea. The contract will be for a period of five years for a weekly service in each direction between Sydney, New South Wales and Salamaua, New Guinea, or, alternatively, between Sydney and Rabaul, following the route Sydney, Brisbane, Rockhampton, Townsville, Cairns, Cooktown, Thursday Island, Wau and Salamaua.

The machine to be used must be multi-engined with a cruising speed of at least 140 m.p.h. and a range of 500 miles against a 30 m.p.h. head-wind. It must be capable of maintaining level flight at 5,000 ft. with one engine cut out. There must be accommodation for six passengers and for a minimum load capacity of 1,400 lb. Tenders close in Melbourne on March 31.

New Zealand Resumation

AFTER an interval of nearly six months the services of East Coast Airways have now been resumed.

The licence for Gisborne aerodrome was withdrawn by the Director of Air Services owing to the unsatisfactory condition of the ground and the necessary improvements have now been completed. Sqn. Ldr. T. W. White and F/O. R. Kirkup will continue as pilots.

Meanwhile in little more than nine months during which Union Airways' service between Palmerston North and Dunedin has been operating over 5,000 passengers have been carried and 98.4 per cent. of scheduled trips have been completed.

The purchase of three Lockheed Electras, for Union Airways' projected Wellington-Auckland service, has been sanctioned by the Minister of Transport.

South African Expansion

AN indication of the rapid expansion of air travel in South Africa is contained in the annual report of the general manager of the South African Railways and Harbours and Airways. He reveals that 10,137 passengers were conveyed by the South African Airways during the year 1935-36—an increase of 7,063, or 229.77 per cent. over the corresponding period of the previous year.

The Government, incidentally, has doubled its order with the Junkers company for ten-seater Ju.86 machines with Rolls-Royce Kestrels. Six of these machines will be delivered early this year. They will have a cruising speed of 216 m.p.h. at rated altitude. When they arrive the total number of Junkers machines in use by South African Airways will be fifteen.

Faster to Hanoi

AIR FRANCE have now replaced the Fokker F.VIIs on the Hanoi link of their Far Eastern service with Potez 62s fitted with two Hispano 12 Xrs. There are four of them on service at present. They will in turn be replaced by Dewoitine 338s, fourteen of which are under construction at Toulouse.

The Potez 62s are 60 m.p.h. faster than the Fokkers, and the Dewoitines will be far larger than the Potez 62s, carrying ten passengers in sleeping chairs. Night flying will not be tried with the Potez, but may be introduced when the Dewoitines have been fully tested and have got into their stride. The eight-day schedule will be kept for the present, although the considerably reduced flying time for each stage of the journey is expected to bring about a considerable speeding up of the time-tables in the near future. A six-day schedule, or less, is envisaged.

Jersey Traffic

A DETAILED analysis of traffic on Jersey Airways' routes shows that 31,229 fare-paying passengers were carried in 1936. Of those, 9,382 travelled on the Heston route, 21,150 passengers travelled between Southampton and Jersey, 315 on the summer service between Plymouth and Jersey and 382 between Jersey and Alderney.

When the Plymouth and Alderney figures are deducted, a fair comparison can be made with those of the previous year, and the figures show an increase of 23.99 per cent. It is interesting to notice that 7,347 passengers were carried in the month of August alone.

During the seven months between March 1 and September 30, 100 per cent. of the scheduled flights were completed. During the remaining five months 37 out of 983 scheduled flights were cancelled or interrupted on the Heston route, and 18 out of 996 on the Southampton route.

The Air Registration Board

REFERENCES have been made in *Flight* to the Air Registration Board, which has been brought into existence through the recommendation of the Gorell Committee.

The Board is divided into four groups representing (1) Operators, (2) Constructors, (3) Insurers of aircraft, and (4) Independent parties not eligible for inclusion in any of the above groups but having some interest in aviation.

The following is a list of those nominated to serve on behalf of various interests:

Group I: E. L. Gandar-Dower (Aberdeen Airport), L. T. H. Greig (Jersey Airways, Ltd.), G. E. Woods Humphery (Imperial Airways, Ltd.), H. E. Perrin (Royal Aero Club).

Group II: G. H. Handasyde (British Marine Aircraft, Ltd.), H. N. St. V Norman (Airwork, Ltd.), F. Handley Page (Handley Page, Ltd.), C. C. Walker (De Havilland Aircraft Co.).

Group III: E. R. H. Hill (Lloyd's Aviation Insurance Assn.), A. G. Lamplugh (British Aviation Insurance Co., Ltd.), L. Murray Stewart (Aviation and General Insurance Co., Ltd.), A. J. Whittall (Lloyd's).

Group IV: Major R. H. Thornton (Alfred Holt and Co.), G. F. Johnson (Accident Offices Association).

Croydon by one of the G.E.C. floodlights.

Realisations and Ideals : Modern Beacons, Floodlights and Marker Lights : What the Pilot Wants

By A. T. VULLIAMY

THE author of this article, Mr. A T. Vulliamy, is in close touch with the subject of aerodrome lighting in his position as electrical engineer with Norman and Dawbarn, the aeronautical consultants

THE development of lighting for night flying has coincided with a great and still continuing advance in the art and science of outdoor lighting. Although in quite a short space of time (the present floodlighting at Croydon was completed in July, 1935, and that at Heston in May, 1935) a comprehensive system of aerodrome lighting, based on international agreement, has become accepted and standardised, we can still look for considerable improvements both in the efficiency of the lights and in their arrangement.

Lighting necessarily has its limitations. Already all the variable qualities, position, intensity, colour and flashing character are being used. More and more of its functions are being duplicated by wireless communication. Taking, for example, the indication of wind and landing direction (a subject by itself), far more precise information and instructions can be given by wireless to machines which are properly equipped. But this calls for the presence of a responsible officer at the control as well as a wireless operator. Even were every aeroplane equipped with wireless receiver and transmitter, it would never be desirable to dispense with the direct visual aids which are provided by lighting systems.

In any weather except fog, snow, or heavy rain, it should, in fact, be possible for a pilot to rely entirely on the ground lighting equipment to enable him to find the aerodrome, to make an accurate and safe approach to a runway or suitable strip of the landing ground, to touch down, and to take off. These four functions may be considered separately, although some of the equipment serves a double purpose.

According to the rules, an aerodrome beacon must be of sufficient intensity to be visible from the nearest air route beacon with an atmospheric transmission of 70 per cent. per mile. Although uniform absorbtion never occurs, this is a useful method of reckoning, and means, roughly, that 30 per cent. of the light is absorbed or scattered per mile. In England very few aerodromes are on lighted air routes, but flights are made cross country in considerably worse visibility than that corresponding to 70 per cent. transmission. Taking the worst conditions in which flights are made without complete wireless guidance (including an approach and landing system) as those corresponding to 2 per cent. to 5 per cent. transmission, it seems reasonable to aim at the use of aerodrome beacons with a range of five miles in these conditions. The beacon would thus always be visible within the local control zone of the aerodrome.

A most important condition, however, is that the beacon shall not dazzle pilots approaching to land and shall not interfere with the control officer's view or his signals to pilots in the air. This is partly a matter of its position in relation to the landing area.

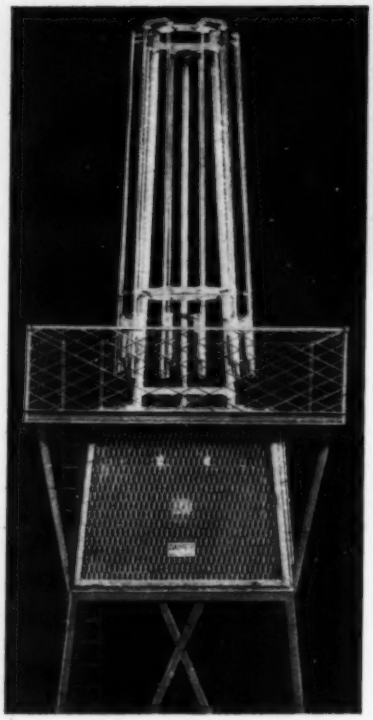
An identification light is also necessary, but this need not have the same range as the main light. In moderate weather the neon tube identification beacon—which, owing to the large apparent area of the light (nearly 50 sq. ft.), does not dazzle—continues to prove satisfactory in England, but near towns it is often in danger of being outshone

by other lights and signs. In bad visibility a much more powerful beacon is required, and perhaps the best compromise will be a rotating beam with or without a red colour screen and a separate red identification light. The power of the main light would be regulated according to the weather.

Both in Germany and the U.S.A. the double-ended rotating route beacon is gaining favour owing to the greater length of flash. This allows the use of alternate white and red or other coloured flashes for identification. A maximum beam candle power (white light) at 12,000,000 is in use.

The power consumed by a route beacon of this type is not considerable unless it has to be generated specially. On long-distance and overseas routes greater ranges may come into use and a beacon near to, if not at, the aerodrome, which in moderate visibility can be picked up eighty miles away will certainly have its protagonists.

Having approached the aerodrome the more complicated the shape of the landing ground becomes, and the greater the number of zoned obstructions in its vicinity the more will the pilot need a really effective system of obstruction and boundary lighting, and perhaps special approach lighting in addition. New methods are already being tried. In the well-known Phillips installation at Welschap Aerodrome at Eindhoven, special threshold lights are placed at 80ft. spacing in addition to the usual obstruction and boundary lights and may be switched on independently to form a strongly lighted threshold to the appropriate runway. The most interesting feature of the threshold lights themselves is that they are of the high-pressure sodium discharge type such as are now used for street lighting at Croydon and elsewhere. This gives an intense and very pure yellow light which is not readily confused with any other. The low-pressure neon discharge tube has long been used in Germany for boundary markers, but the Dutch installation is one of the first steps in the use of the recently developed high-pressure discharge lamp, from which much is expected in the future.

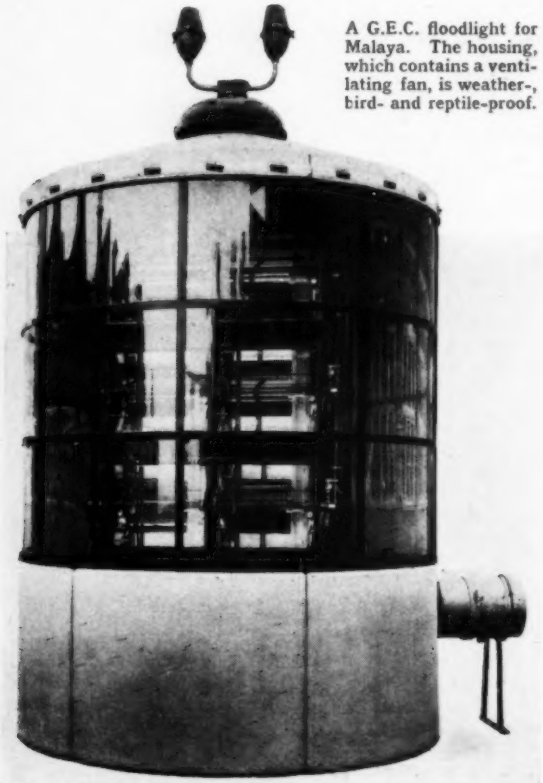


The neon tube airport identification beacon by Clarke Chapman.

The Chance flush-fitted marker light of the type referred to by the author.

Threshold lights alone do not give the landing direction, and another system used in America, and recently installed by the Westinghouse Electric Co. at Basrah, makes use of green marker lights placed at the near and far ends of the runway. All the lights may be switched on, with the boundary lights, and the markers for each runway are distinguished by difference of number or grouping. This system depends for its success on good visibility and it may also fall short of what is wanted for landing out of wind.

The system which in theory seems most attractive is the line of marked lights set flush in the surface of the runway itself. A number of such lights are in use throughout the world. They must project as little as possible and must be very robustly constructed. It is in consequence very difficult to get a satisfactory intensity of light at an angle less than 40 deg. from the horizontal. Since, when making a normal approach, they may be viewed from 5 deg. to 20 deg. above the horizontal, this is a grave drawback which still remains to be overcome.



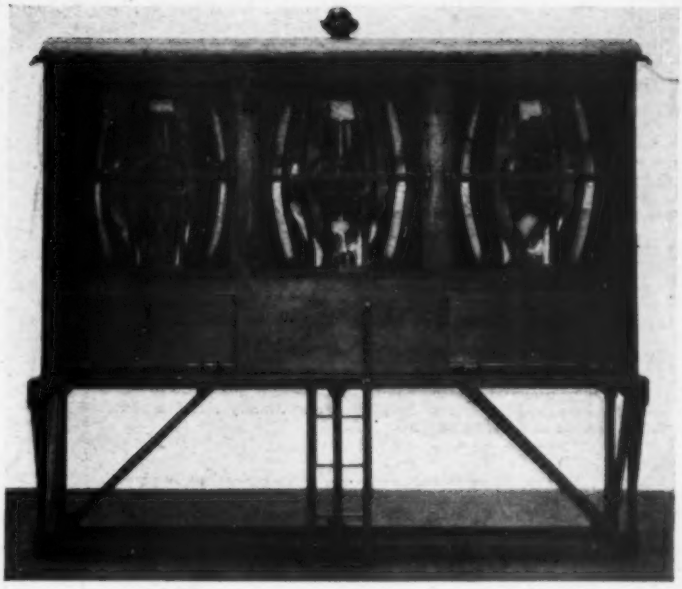
A G.E.C. floodlight for Malaya. The housing, which contains a ventilating fan, is weather-, bird- and reptile-proof.

A *Boundary-light "Horizon"*

Where landings are confined to surfaced runways use may be made of lights of the boundary marker type, which are designed to be easily knocked over without damage to aircraft. These lights may be adapted to illuminate the surrounding ground surface and so help in the next problem—which is to enable the pilot to touch down on the surface of the landing ground. Given reasonably level ground, many pilots find the horizon provided by the boundary lights of the utmost value for this purpose. It is consequently most important that these should have a good intensity in the horizontal plane and stand sufficiently high above the ground.

It seems to be admitted universally that for a normal "all ways" grass-covered aerodrome, the floodlight gives to a pilot without much experience of night flying the best chance of making a good landing. The intensity and number of floodlights used is consequently increasing.

A 4½-kw. Chance floodlight in mild steel housing.



Nine kilowatts is now a normal power consumption for a single unit. The enclosure of the whole unit in a housing is also gaining favour.

One drawback of the floodlight is that it always constitutes an obstruction, and where it is necessary to mount it on a structure sometimes 15 to 20 ft. high, owing to the uneven surface of the aerodrome, it may become a dangerous one. It seems, however, that very few accidents have been thus caused, either by night or day. Another criticism of the floodlight is the very strong intensity of light on the ground close to it. This tends, to a small extent, to dazzle the pilot, and he is carried on to more feebly illuminated areas more quickly than his eyes can recover. This is where the aeroplane's landing lights score.

It is entirely on the pilot's eyes that the utility or otherwise of the lighting depends, and it is probable that the success of floodlights is almost entirely due to the small irregularities of every grass, mud or rock surface. Over a large expanse of perfectly flat, smooth and uniformly coloured surface the eyes would have nothing on which to focus; their stereoscopic powers would be defeated and both flood and landing lights would be largely ineffective. A surfaced runway approximates to such conditions, and the remedy here is the flush-type marker light. This may be used with equal effect in an "all ways" field if use is made of a suitable even and geometrical arrangement of the lines of lights, and one with which the pilot is familiar. The same improvements as mentioned above are required here also, and some help may be found by indirect lighting. Flush marker lights are rendered ineffective by snow, but they are good in a ground mist, when indirect lighting is useless and floodlights and landing lights may be very nearly so.

The fourth problem, that of lighting to aid take-off, is simple in good visibility. Boundary and obstruction lighting suffices and floodlights are an improvement. In the case of surfaced runways illuminated targets or special marker lights are used. In bad visibility a line of lights in the surface of the ground itself is the best solution, and here again there is a demand for an improved flush marker light with a good intensity near to the surface.

Some recent accidents show that it is necessary for the ground staff to be prepared for a sudden return to the aerodrome of a departing machine, and possibly an emergency landing out of wind, for which the appropriate floodlights must be ready.

In large installations it is important that the switches controlling the whole of the lighting should be grouped on a panel in the control room. Moreover, tell-tale lamps indicating that the various sections of the equipment are working properly should be mounted on the panel where they can be seen by the officer in charge. If effective use is to be made of even the smallest installation, all the lighting should be controlled from a central point, preferably a properly planned control room.

Many of the developments mentioned are likely, for the time being, to apply only to large aerodromes where scheduled night services are expected. For emergency use, for experienced private pilots and for charter flights, boundary and obstruction lights, illuminated wind indicator and beacon (assisted by flares in bad weather) may continue for some time to prove adequate. This is what is specified in an Air Ministry pamphlet, and represents the minimum that should be provided at every aerodrome licensed for public use. The addition of a mobile floodlight is of real value, provided that it is ready for use at any time at short notice.

GLOSTER'S NEW CHIEF

MR. H. P. FOLLAND has resigned from the post of chief designer and engineer to the Gloster Aircraft Co., Ltd., and Mr. W. G. Carter has succeeded him. Mr. Carter was chief draughtsman at the Sopwith company during the war and later joined the Hawker company as chief designer, being responsible for the Horsley which proved so successful. Later he was responsible for the design of the Short Crusader Schneider machine, which turned out a very fine seaplane but was wrecked off Venice through crossing of the aileron cables. After a time Mr. Carter joined the De Havilland company in connection with certain military types, and when these were transferred to the Gloster company Mr. Carter followed them and has been with this firm ever since, except for a short period with A.V. Roe and Co., Ltd.

Forthcoming Events

January 21. R.Ae.S. (Coventry Branch) Lecture: "Air Route and Aerodrome Control," by L. A. Sweny. Armstrong Siddeley Canteen, 8.15 p.m.
January 20-22. Aerodrome Owners' Association: Airports Exhibition and Conference.
January 28. R.Ae.S. Lecture*: "Plastic Materials," by Dr. N. A. de Bruyne.
February 3. Royal United Services Institution Lecture: "The Anti-Aircraft Defence of Great Britain," by Maj.-Gen. R. H. D. Thompson.
February 5. Cinque Ports Flying Club: Annual Dinner and Dance.
February 10. Yorkshire Aviation Services Annual Dinner and Ball, 8 p.m., Grand Hotel, Harrogate.
February 11. R.Ae.S. Lecture*: "The Automatic Pilot," by Mr. F. W. Meredith and Mr. P. A. Cooke.
February 12. De Havilland Technical School Annual Dance. 9 p.m., Hyde Park Hotel, London, W.1.
February 17. Royal United Services Institution Lecture: "Air Force Co-operation in Policing the Empire," by Air Comdr. C. F. A. Portal.
February 18. R.Ae.S. Lecture*: "Possible Layouts for Air-cooled Engines," by Mr. A. H. R. Fedden.
February 18. Civil Aviation Service Corps: Dance, First Avenue Hotel, London.
February 25. R.Ae.S. Lecture*: "Power Measurements in the Air," by Mr. N. S. Muir.

* These lectures take place at the Royal Society of Arts, 18, John St., London, W.C.2, at 6.30 p.m. Admission is by ticket obtainable through a member.

FROM the CLUBS

CAMBRIDGE

MARSHALLS' Flying School put in 27 hr. 30 min. flying last week, but fog and high winds curtailed activities on two days. Cross-country flights were made to Heston and Norwich.

C.A.S.C.

During the week-end members flew 8 hr. 20 min. Mr. J. G. French has taken his initial flight with the Corps.

LIVERPOOL

Flying times for January to the 16th amount to 69 hr. 40 min., weather conditions having improved considerably during the past week. A very successful night landing competition was held on Saturday, January 16, and was won by Mr. W. Greenhalgh.

MIDLAND

Members of the Midland Aero Club flew 10 hr. 45 min. dual and 13 hr. 50 min. solo and passenger during the week ended January 15. Miss D. Henderson has joined the Club as an ordinary member and Mr. N. Forbes as a flying member.

SOUTHEND

Flying activities, owing to better weather, were exceptionally good last week. The Club has a new "B" licence pupil, namely, Mr. D. C. Howell. The Carnival Dance held recently was a great success, being very well attended, and the monthly club supper is fixed for to-morrow (January 22).

PORTSMOUTH

The total flying times for the week ended January 15 amounted to 21 hr. 45 min., bad weather preventing flying instruction on four days of the week New members are Messrs. R. S. Wanhill and F. J. Rump, while Mr. P. R. Hornidge is now undergoing instruction for his "B" licence.

YORKSHIRE

Club machines flew eleven hours last week, and the total for the month of December was 30 hr. 35 min., bad weather prevailing generally throughout the month. Mr. G. H. Michell, of Australia, has joined the Club as an overseas member, and Mr. O. A. Bird has joined the Aviation Group.

SOUTH COAST

Owing to adverse weather conditions only twenty hours' flying was logged last week, but Mr. F. C. White managed to go solo. The annual general meeting and dinner dance held last Saturday was very successful, ninety people being present at the dinner, and over a hundred at the dance, including a large number from Brooklands.

CROYDON

Machines of the Croydon Flying Club spent 20 hr. 10 min. in the air last week. Two new members have joined the Club, Mr. W. E. Noordink and Mr. H. Hood, both being under instruction for "B" licences. The Club's Dragonfly is proving very popular as a means of obtaining dual instruction in twin-engined machines, and several members are taking the opportunity of gaining experience on this machine as a stepping stone to others.

BRISTOL AND WESSEX

Flying time for the fortnight ended January 16 totalled 29 hr. 30 min. Mr. A. D. Brodie has completed the tests for his "A" licence. The Club has ordered a new Cirrus Minor Swallow, the registration of which is G-AESL. The Cadet has gone to Heston for complete engine overhaul and will be out of commission for the next fortnight. The Club dance this year will be held at the Berkeley, Queen's Road, Clifton, Bristol, on February 4, from 9 p.m. to 2.30 a.m.

HANWORTH

Unfavourable weather kept flying time down to 35 hr. 20 min. during the week ended January 16. New members were Miss Rogers, Messrs. Edmonds (National League of Airmen), F. W. Broughton, V. R. Dickson, Poole, and R. Austin. Cross-country flights were made to Shoreham, to Leicester and return. The Leopard was hired for a flight to Leicester, and the Heck was hired by Mr. Bramson. One of the school machines is out of commission for a time owing to C. of A. overhaul. More Aeroncas will shortly be available for hire and instruction.

NORFOLK AND NORWICH

During the week the Club increased its fleet of aircraft by the purchase of a Gipsy II metal Moth, G-ABRF. It has been thought necessary to make this purchase in view of the rapidly increasing flying hours and pupils. The members of the Round Table have been invited by the Club to debate with the members a motion of their own choice. They will move "that aviation in this country will not become of practical value to commerce during the next decade," and they have the advantage in that they have been allowed to frame the motion in words of their own.

LONDON

Last week's flying totalled 24 hr. 20 min., Mrs. E. Rowley and Mr. F. C. Rowley joining as new members.

YAPTON

The total flying time at the Yapton Aero Club for January to the 16th was 26 hr. 30 min., first soloists being Messrs. R. A. Hubbard, B. C. Ling and Nigel Hill.

REDHILL

Hours for the week ended January 15 amounted to 30 hr. 55 min. Messrs. Davis and Clayton have passed their "A" licence tests, while Mr. Grant has gone solo. The Club Puss Moth is back from Germany and there are four new flying members.

LEEMING

Flying time for the week amounted to 15 hr. 25 min. Sixty members attended the monthly dance in the clubhouse, this small attendance being due to the influenza epidemic and the exceedingly foggy weather. Visitors to the Club during the week were Mr. Randolph in his Vega Gull, after a night landing on Scarborough Race Course in very bad weather, and Mr. G. R. Armstrong in his B.A. Swallow. The plans for the erection of a large new hangar have been passed by the Corporation and work is expected to begin almost immediately. New members are Mrs. Cameron, Messrs. Stannard, Soutar and Wailes, while Mr. Fairbank has gone solo.

CINQUE PORTS

For the week ended January 13 flying times totalled thirty-two hours. The annual general meeting of the Club will be held on January 24 to receive the managing director's statement on the year's working and to elect a committee for the forthcoming year. The Club recently had a visit from No. 601 Auxiliary Squadron from Hendon. A flight came over to do some aerial gunnery on the Lydd ranges, and the officers had lunch at Lympne. The Club's Aeronca, which has been in the workshops for some time, is now in service again. It has been repainted in the silver, blue and red of the Club colours.

BROOKLANDS

New members last week were Mr. J. E. Lydall, Mr. Glossop, Mr. P. H. Allen and Lt Carver, who is a member of the Royal Engineers' Flying Club, and who is renewing his "A" licence at Brooklands. The Hon. Fermor-Hesketh, who has been stationed abroad for some time, has now returned to England and is at the moment waiting delivery of his new Miles Whitney Straight. Forthcoming events at Brooklands include the annual general meeting on January 23, a lecture on navigation on Sunday, January 24, a height judging competition on Sunday, January 31, and on Friday, February 26, the second annual dinner and dance of the Brooklands Associated Clubs, which will be held at the Mayfair Hotel.

BORDER

During the week ended January 10 the improvement in the weather resulted in a corresponding increase in flying hours, viz., 18 hr. 50 min., quite a considerable amount of this being solo. Six members of the committee, in three machines, recently paid a semi-official call on the Newcastle Aero Club. It is hoped to pay similar visits to other clubs each month. The Dawn Patrol scheduled for January 31, is not receiving much support. With the exception of eight machines from Newcastle, no others have been promised. The unpleasantness of crossing the hills in winter seems to be the main reason. Border Flying Club members are forced to cross these on every cross-country flight and have acquired a special technique.

Verboten

NO machines, other than those of the German Air Force, will in future be permitted to enter a stretch of territory lying between the Rivers Oder and Warth on the German-Polish frontier. Civil machines will need to pass either to the north or the south of this fifty-mile stretch.

Fly Yourself

LAST year's record of Air Hire, Ltd., tends to confirm the increase in private flying which has been noticeable in all quarters; 1,750 hours, representing approximately 160,000 miles and an 8½ per cent. increase on last year's figures, were flown during the year; 495 'fly-yourself' contracts were completed, and no serious accidents occurred to any of the company's aircraft during the year. It would be interesting to know how many "drive-yourself" car hire firms have passed through 1936 with as clean a copy-book. Outstanding flights included that of Mr. Ralph Dundas to Vienna, Athens, the Dalmatian coast, Paris, Scotland and back to Heston in the course of a month's holiday in a Leopard Moth.

FLEET AIR ARMS OF THE WORLD

Vought SBU-1 scout-bombers of the U.S. Navy.

Part II. : Foreign Equipment : Specialised Aircraft

By H. F. KING

THE carrier strength of the U.S. Navy was discussed briefly in last week's instalment of this article. The U.S.N. has paid great attention to the provision of aircraft on cruisers, all such vessels being fitted with at least two catapults. Certain of the newer craft carry four seaplanes (of the Vought Corsair central-float type), while one, the *Augusta*, is listed by *Brassey's Naval Annual* as having accommodation for eight machines, although she normally carries only six.

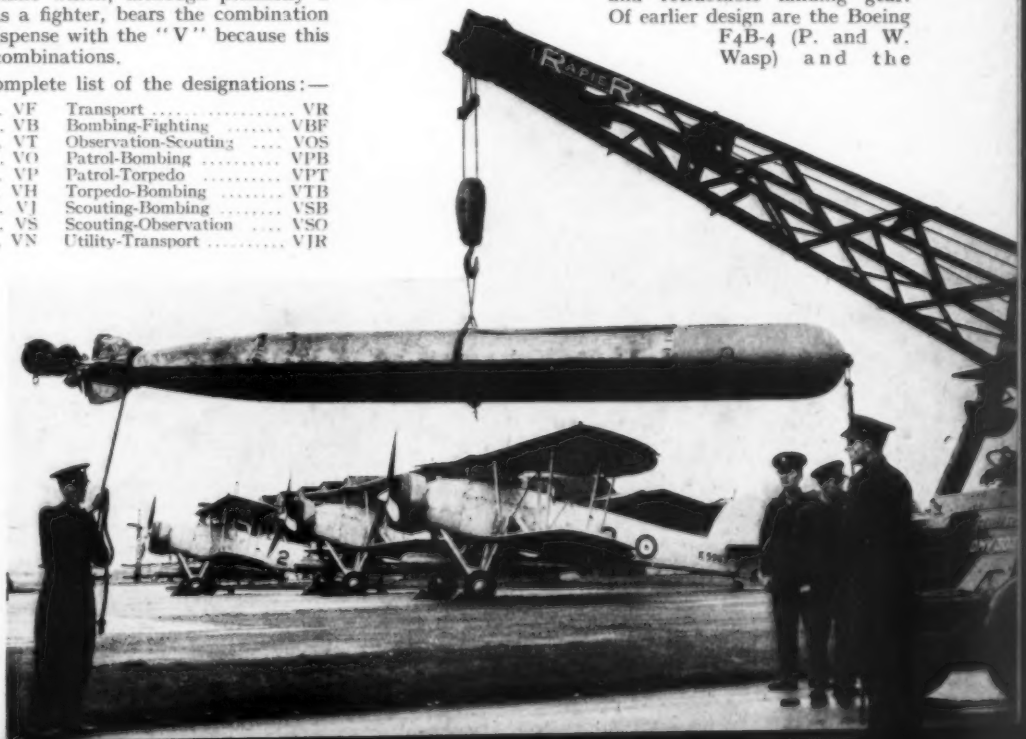
Some of the most interesting fleet aircraft in the world are being used by the U.S. Naval Air Service or are on test in America. A few of these were illustrated last week. The American Navy's system of designating their aeroplanes is interesting if somewhat appalling to the uninitiated. Each class of machine is allotted a combination of two letters; should an aircraft be capable of functioning in more than one form a third letter may be used. For example, bombers are symbolised by the letters VB, but a machine which, although primarily a bomber, is applicable as a fighter, bears the combination VBF. It is usual to dispense with the "V" because this is common to all the combinations.

The following is a complete list of the designations:—

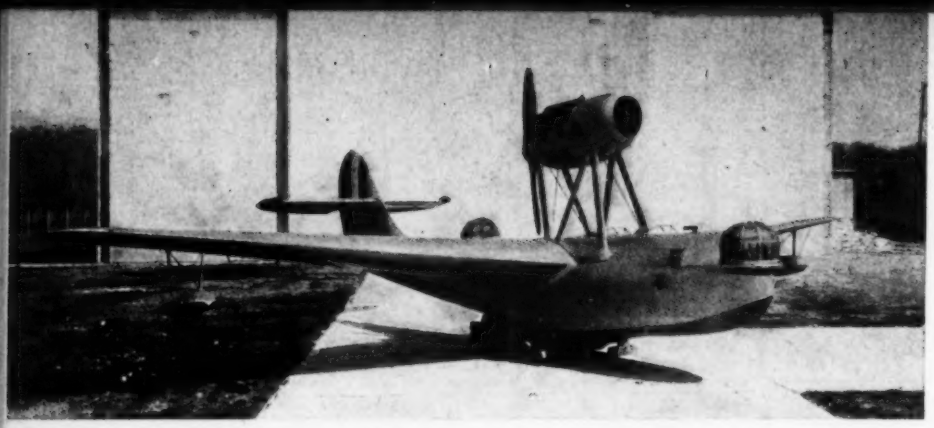
Fighting	VF	Transport	VR
Bombing	VB	Bombing-Fighting	VBF
Torpedo	VT	Observation-Scouting	VOS
Observation	VO	Patrol-Bombing	VPB
Patrol	VP	Patrol-Torpedo	VPT
Ambulance	VH	Torpedo-Bombing	VTB
General Utility	VJ	Scouting-Bombing	VSB
Scouting	VS	Scouting-Observation	VSO
Training	VN	Utility-Transport	VJR

Up to the present no monoplanes are in large-scale operation with the U.S. Navy, but orders have been placed for Douglas torpedo bombers and Vought scout-bombers built to a completely modern formula.

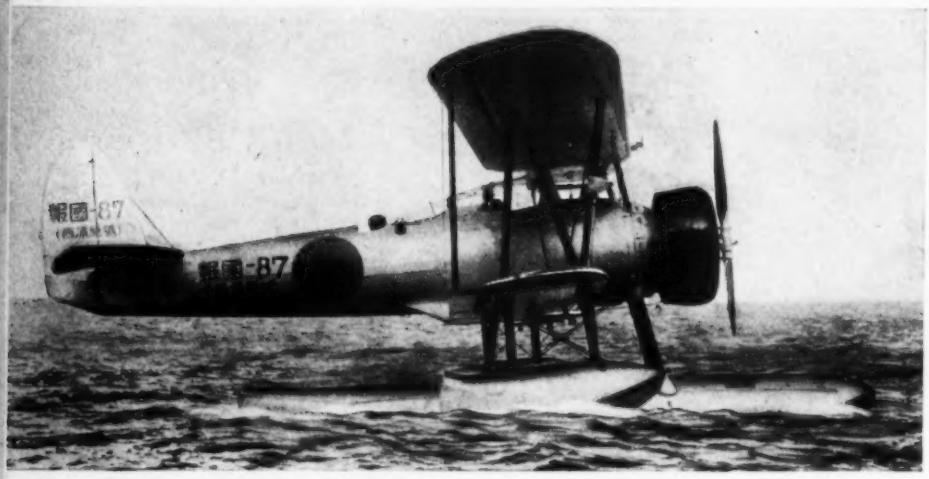
Purely for fighting, the U.S. Navy is using Grumman biplanes of single- and two-seater types. The single-seaters are the F2F-1 and the F3F-2, the former with Pratt and Whitney Twin Wasp Junior two-row radial (in the development of which engine the U.S.N. played a big part) and the latter with a Wright Cyclone G. They are said to attain speeds between 230 and 250 m.p.h. The two-seater fighter is the FF-1, with Cyclone engine, a similar machine to the SF-1 scout, also a standard type. These Grummans are metal biplanes with retractable undercarriages and are not to be confused in flight with the Curtiss BF2C-1 single-seater which functions as a dive bomber and single-seater fighter and is a development of the Hawk series. The BF2C-1 also has a Cyclone engine and retractable landing gear. Of earlier design are the Boeing F4B-4 (P. and W. Wasp) and the



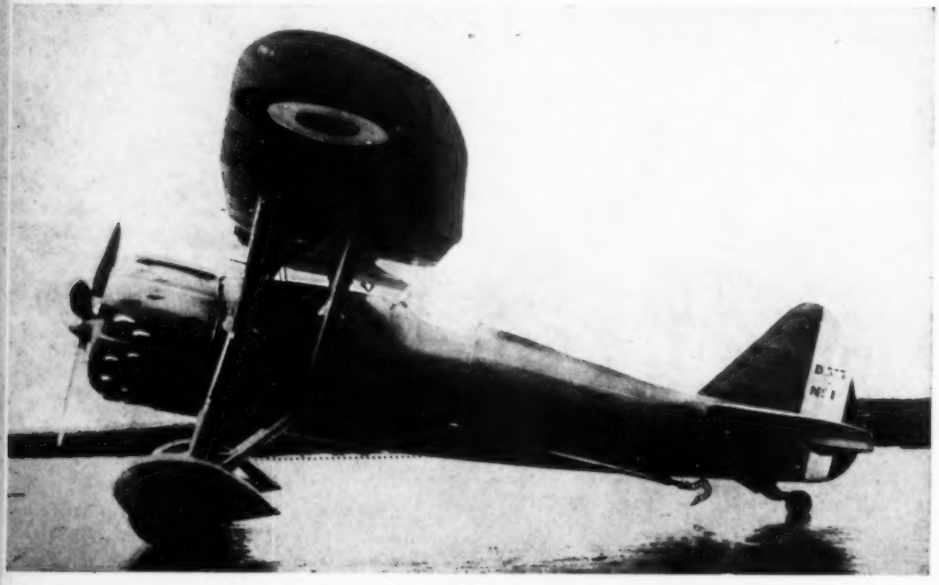
Fairey Swordfish torpedo-spotter-reconnaissance machines (Pegasus III) ready for torpedo practice at Gosport.



A high-performance Italian bombing and reconnaissance flying boat (750 h.p. Isotta-Fraschini "Asso.").



Japan uses this type of machine—the Navy 95—for reconnaissance.



France's new single-seater fleet fighter: The Dewoitine D.373 with Gnome-Rhone K.14 engine.

Curtiss F11C-3, which is basically similar to the bomber-fighter, but has a fixed cantilever undercarriage.

A few obsolescent Martin two-seater dive bombers capable of handling 1,000 lb. projectiles are on charge, but it seems that these are being superseded by BG-1s made by the Great Lakes concern. These have Twin Wasp fourteen-cylinder engines and do about 180 m.p.h.

Various models of the Vought Corsair, with wheel or float undercarriage and Wasp engine, are used from carriers and catapult-equipped warships. The very latest development in this well-tried series, used, apparently, exclusively with wheel undercarriage, is the SBU-1 scout bomber with tapered wings and Twin Wasp Junior engine.

Like other navies, the U.S.N. has been experimenting with Autogiros, and has lately taken delivery of a Wilford Gyroplane with 155 h.p. Kinner radial and float undercarriage. A Curtiss monoplane with two engines is rumoured to be under development for carrier work.

France

The French Navy has only one aircraft carrier of accepted type (*Béarn*), the *Commandant Teste* being classed as an aviation transport and having no flight deck. The *Béarn* displaces 22,146 tons and is a comparatively slow vessel, making only about 21 knots. She has accommodation for 41 aircraft, or roughly double that of the *Commandant Teste*.

A great deal of obsolescent equipment is on hand, but is gradually being replaced. The new standard fleet fighter is a single-seater Dewoitine parasol monoplane with 800 h.p. Gnome-Rhone Mistral Major (K.14) fourteen-cylinder supercharged radial. This machine, equipped for deck landing, is capable of about 230 m.p.h. and is armed with four machine-guns.

The French Navy has shown interest in the possibilities of the fleet-fighter / dive-bomber type and had constructed for test a low gull-wing monoplane, known as the 140 C.2, equipped with a 690 h.p. Series X Hispano Suiza "cannon" engine, and capable of 208 m.p.h. Unhappily, this machine disintegrated during diving trials.

An unusual shipboard reconnaissance type has been adopted, this being the Potez 452 monoplane flying boat with 350 h.p. Hispano Suiza radial. A two-seater, the 454, is stressed for catapulting, and is fitted with Handley Page automatic slots, giving it a minimum flying speed of 45 m.p.h. The maximum speed is 134 m.p.h. A single-seater fighter similar in conception has also been built as a prototype, and with one of the new 700 h.p. two-row Hispano radials, is capable of 208 m.p.h. Two fixed machine-guns or one 20 mm. *canon* can be specified.

It seems that the Hispano-engined Levasseur biplanes used for reconnaissance will soon give way to new equipment. The fuselage of this type of machine is specially strengthened and fitted with a planing bottom not unlike that of a flying boat, and the undercarriage has an

instantaneous release arrangement permitting safe forced alightings on the water. A number of Gourdon-Leseure 810 twin-float seaplanes are used for spotting and reconnaissance.

Realising the potentialities of dive-bombing in naval operations, the French Navy has ordered a series of Gourdon-Leseure single-seater dive-bombers of the 432B.1 type. These machines are parasol monoplanes with Gnome-Rhone nine-cylinder radial engines. Their sphere of usefulness appears very limited, for their performance is not sufficiently high to justify their employment as first-line single-seater fighters.

Visitors to the Paris Show in 1934 may recall a Levasseur seaplane built for the French Navy, in which the fuselage was, in effect, simply a nacelle containing the engine (a nine-cylinder Gnome-Rhone), the tail being carried on the swept-up ends of the floats. This machine met with an accident, but an improvement, the PL201 is now on test.

Twin Engines

Perhaps the most interesting prototype on hand is the Potez 56E, intended for tests on the *Béarn* to ascertain the value of twin-engined machines for carrier operation. Landings will be made with one engine stopped, and observations made of the take-off characteristics. A maximum speed of 180 m.p.h. is claimed with two 185 h.p. Potez radials.

There is a possibility that an order will be placed for a number of Romano R.90 single-seater fighter seaplanes. The R.90 is a biplane with gull-type upper wings, and is said to be capable of 217 m.p.h. when fitted with an 860 h.p. Hispano.

In production at the moment is the Loire 130 three-seater spotter-reconnaissance flying boat, a monoplane with a 690 h.p. Hispano X engine mounted above the wing.

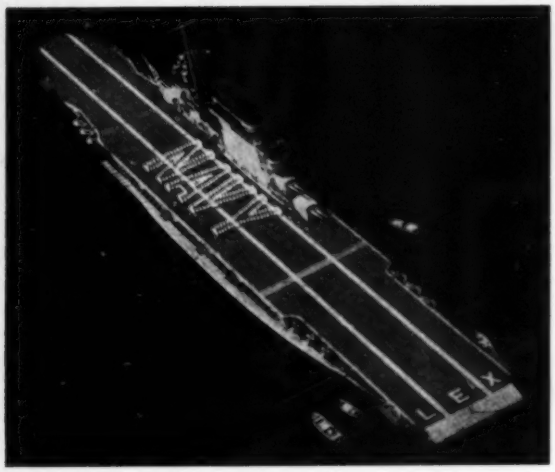
Italy

Flying boats are favoured by the Italian Naval Aviation Corps for over-water operations, and aircraft of this type are used as single-seater fighters, for reconnaissance and spotting, and as bombers. Italy has no carriers with a flight deck, and naval flying is done from battleships and cruisers and the 5,000-ton seaplane carrier *Miraglia*. The chief types in use from naval vessels are the Macchi M.18 two-seater reconnaissance flying boat, the C.M.A.S.A. M.F.4, also a reconnaissance type, the Cant 25 single-seater fighter, and a small variety of other types. The shore-based machines, which are capable of co-operating with the Navy, are more numerous and varied.

Little has been heard of new prototypes, and, judging from the

A Vought Corsair being catapulted from the U.S.S. *Arkansas*. The central-float arrangement is very popular in the U.S. Navy.

(Above) A Fokker C.11-W seaplane of the Dutch Navy departs on its lawful occasions. (Below) One of our own Hawker Ospreys warming up. (*Flight* photographs.)



The deck of the great American carrier *Lexington* makes a first-rate display ground.

machines whose characteristics have been made public, there is nothing of outstanding interest.

Incidentally, the development of dive bombing has not been fostered by the Italian Naval Aviation Corps, despite the reports of the "suicide diving" tactics which entail the deliberate crashing of a bomber full of explosives on the deck of a warship.

Japan

A formidable force of aircraft carriers is a feature of the Japanese navy, the total tonnage of existing vessels and those under construction falling only about 40,000 tons short of the figure for the British Empire's carrier force.

Japan's two largest carriers are the *Akagi* and *Kaga*, both of 26,900 tons displacement. The *Akagi* is the more recent vessel, and is capable of over 28 knots. She has accommodation for fifty machines. Next in order of size is the *Kamoi* (17,000 tons), a seaplane carrier, and the *Notoro*, a ship of similar type. Then there are the *Hosho* (7,470 tons) which has a flight deck and stowage for 28 aircraft, and the newer *Ryujo* of 7,100 tons. Work is under way on the *Soryu*, a vessel of advanced design and 10,000 tons displacement.

Very little, if any, of the aeronautical equipment is of up-to-date design. For reconnaissance work there are Navy 90, 92 and 95 types (some two- and some three-seaters) and some 94 three-seaters. American influence is apparent in the design of much of the reconnaissance equipment, the Nakajima 90-11 being difficult to distinguish from the earlier types of Vought Corsairs.

The standard deck-landing fleet fighter is the Nakajima 90 single-seater (not to be confused with the 90-11 reconnaissance model), which has a Nakajima-built Jupiter engine and a maximum speed of about 190 m.p.h. Bristol influence is reflected in the design of the airframe, the wing cellule being reminiscent of the Bulldog and Bullpup series. For dive bombing the Imperial Japanese Naval Air Service employs Type 94 biplanes, large two-bay machines generally similar to the Aichi 92 reconnaissance aircraft also in service.

A force of assorted shore-based flying boats and float planes of obsolescent design is available for naval co-operation.

In addition to the works of the Nakajima, Mitsubishi, Kawanishi and Aichi concerns, naval aeroplanes are built at the Yokosuka and Sasebo Naval Yards.

The only reasonably sized forces of ship-borne aircraft are possessed by Great Britain, America, France, Italy and Japan, but smaller nations can show something of interest in the matter of naval aeronautics. There is, for example, Sweden's aircraft-carrying cruiser *Gotland*, a visit to which was described in *Flight* of February 13, 1936.

Holland is not overlooking the possibilities of marine aircraft, and Germany is said to have ordered an aircraft carrier. Pending its completion seaplane flying is receiving plenty of encouragement.

PROGRESS

Thirty-one Municipal Airports Now in Use in This Country : Their Relation to the Air Routes : Britain on the Continent

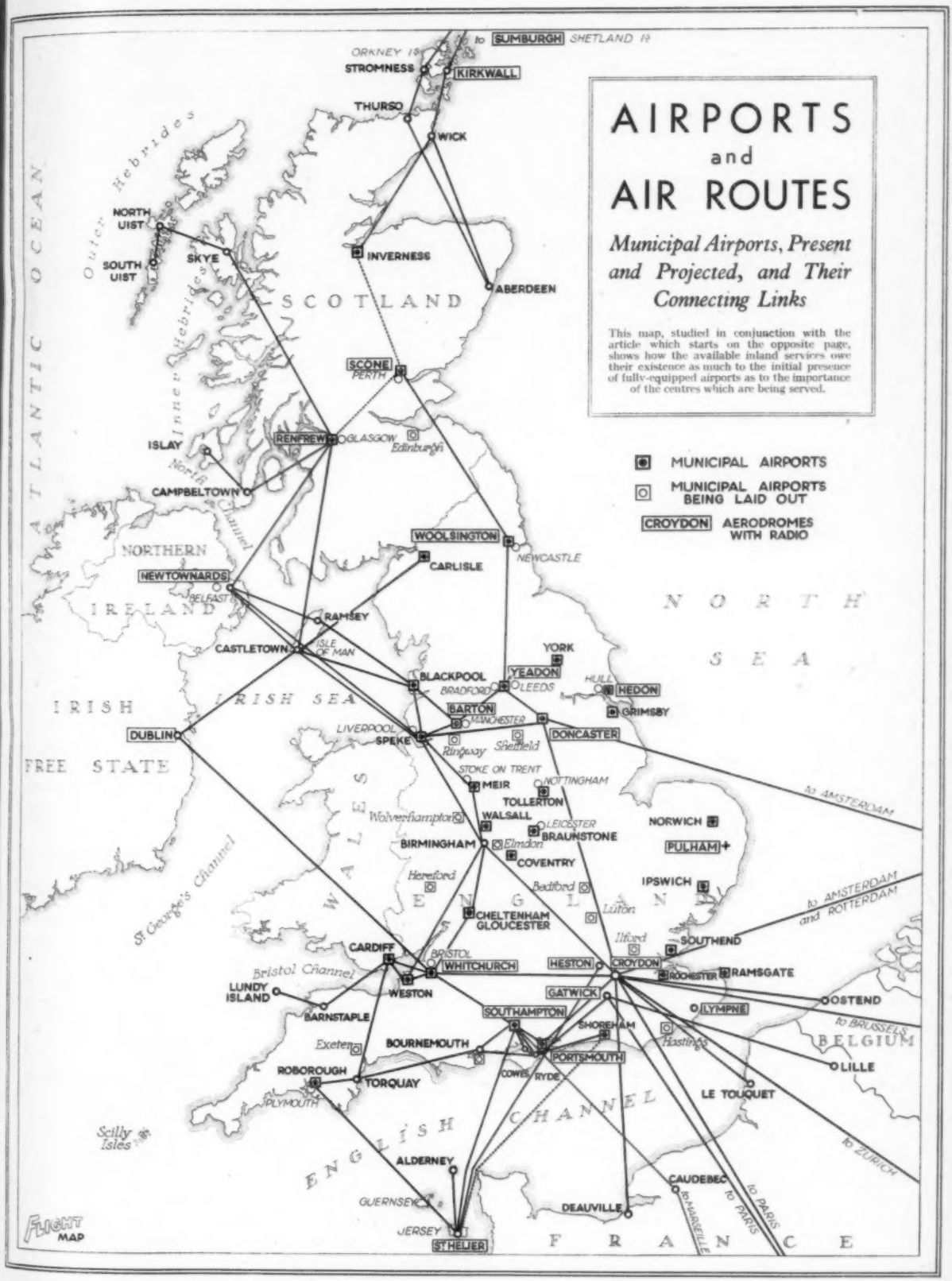
WHEN we remember the very considerable expense involved in airport layout, it is not really surprising that the number of municipal airports in this country has risen so comparatively slowly. The present total of thirty-one can, in fact, be considered as extremely high in the circumstances, and more towns than ever before are displaying practical interest to the point of reserving sites in their planning schemes.

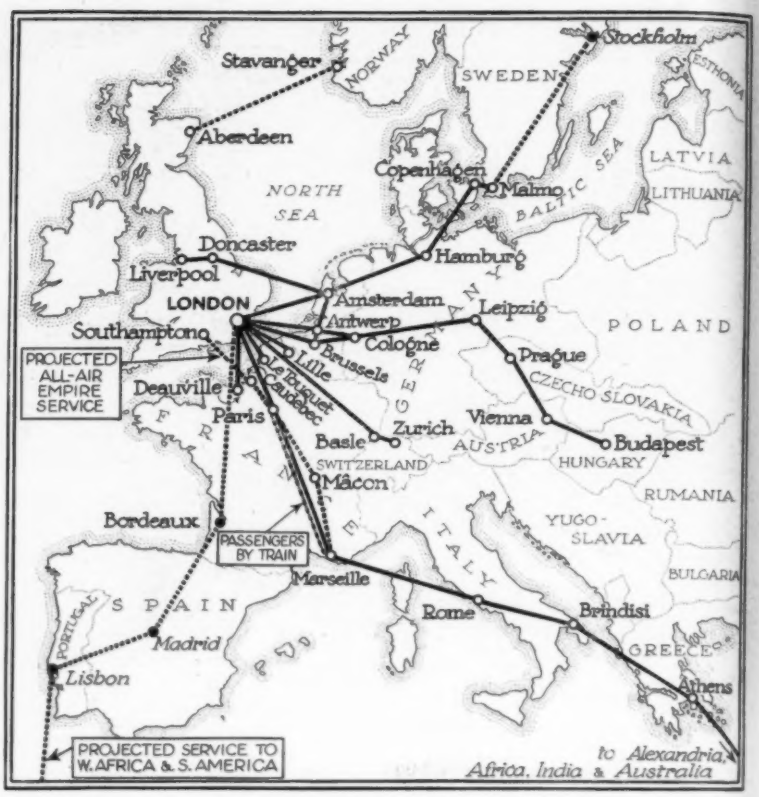
The map on the opposite page will give the present position at a glance, but it should be remembered that the connecting air route system, though temporarily stabilised, is by no means final. The future will depend to some considerable extent on the recommendations of the Maybury Committee, whose report will probably have been published by the time this issue appears. Modern airline operation is virtually impossible without the assistance of radio direction-finding services, and it is encouraging to see the extent to which these services have expanded during the last year or two. Since January of last year eight new stations have come into being, mainly in the North, where they were so urgently needed. The present year will probably see a few additions to the number, notably at Inverness, where a D/F station is expected to start work in good time for the summer operations.

In *Flight* of November 5 last year the internal air route system was reviewed and a map published showing both the disposition of the Services and the companies operating them. It is too early in the year to give any concrete suggestions concerning likely extensions, and the services shown are those which were being operated during this winter and at the conclusion of the 1936 summer. One or two services which are known to be likely starters have been indicated by means of broken lines.

Before air services can run, even by day, with a regularity comparable with that obtained with surface transport, co-ordinated ground equipment is essential. The airline operators cannot afford to provide it for themselves, and the municipal and Government authorities have said, in effect, that until the services are in existence there is no possible point in providing it—a vicious circle of demand and supply. This circle is by no means as close as it was, and year by year we should see demand and supply keeping pace with each other.

As far as night operation is concerned the position is almost exactly the same. In this case, however, there is an added difficulty. Until floodlighting and blind approach equipment is available the services cannot be operated, and until they are run the pilots will have no chance of gaining experience in such work. The equipment necessary for all-weather night-time flying is comparatively expensive, and it will probably rest with the Air Ministry to come at least part of the way in the matter of payment. In laying out an aerodrome by itself a municipality has only done half its work, and it might almost


AIRPORTS
and
AIR ROUTES
Municipal Airports, Present and Projected, and Their Connecting Links
This map, studied in conjunction with the article which starts on the opposite page, shows how the available inland services owe their existence as much to the initial presence of fully-equipped airports as to the importance of the centres which are being served.
MUNICIPAL AIRPORTS
MUNICIPAL AIRPORTS BEING LAID OUT
CROYDON AERODROMES WITH RADIO
to SUMBURGH
SHETLAND Is
ORKNEY Is
STROMNESS
KIRKWALL
THURSO
WICK
NORTH UIST
SOUTH UIST
SKYE
INVERNESS
ABERDEEN
Outer Hebrides
Inner Hebrides
SCOTLAND
SCONE
PERTH
ISLAY
RENFREW
GLASGOW
Edinburgh
CAMPBELTOWN
North Channel
ATLANTIC OCEAN
NORTHERN IRELAND
BELFAST
NEWTOWNARDS
WOOLSINGTON
NEWCASTLE
CARLISLE
RAMSEY
CASTLETOWN
ISLE OF MAN
IRISH SEA
YORK
BLACKPOOL
BRADFORD
LEEDS
YEADON
HULL
HEDON
GRIMSBY
BARTON
MANCHESTER
LIVERPOOL
SPEKE
Ringway
Sheffield
DONCASTER
DUBLIN
FREE STATE
STOKE ON TRENT
NOTTINGHAM
MEIR
TOLLERTON
WALSALL
Wolverhampton
LEICESTER
BRAUNSTONE
BIRMINGHAM
Elmdon
COVENTRY
NORWICH
PULHAM
IPSWICH
Hereford
Bedford
Luton
CHELTENHAM GLOUCESTER
St. George's Channel
WALES
ENGLAND
Ilford
SOUTHEND
CARDIFF
BRISTOL
WHITCHURCH
HESTON
CROYDON
ROCHESTER
RAMSGATE
Bristol Channel
LUNDY ISLAND
WESTON
GATWICK
OSTEND
LYMPNE
BARNSTAPLE
SOUTHAMPTON
SHOREHAM
Hastings
Exeter
BOURNEMOUTH
PORTSMOUTH
ROBOROUGH
TORQUAY
COWES
RYDE
LILLE
LE TOUQUET
PLYMOUTH
ENGLISH CHANNEL
Scilly Isles
ALDERNEY
GUERNSEY
JERSEY
ST HELIER
DEAUVILLE
CAUDEBEC
FRANCE
NORTH SEA
to AMSTERDAM
to AMSTERDAM and ROTTERDAM
to BRUSSELS
BELGIUM
to ZURICH
to MARSEILLE
to PARIS
FLIGHT MAP



The British air services to the Continent and beyond as they appear at the present time. Projected services are indicated by means of broken lines, but the eventual service to West Africa and South America will not necessarily follow the overland route shown. This route was that originally planned for a British service to Spain and Portugal.

be better to leave the idea entirely alone than to provide an insufficiently large aerodrome with little or no equipment. The local authorities, however, have the ratepayers with whom to contend, and can hardly be blamed for tackling the job piecemeal. Unfortunately, these same ratepayers may complain because no airline companies use their aerodrome when it is that and no more. An airport without equipment is like a railway station with neither rails nor a signalling arrangement.

Those towns and cities indicated on the map as being in the very act of laying out aerodromes are only those which, to the extent of our knowledge, have actually started work. There are probably others, and certainly a number of unmarked towns have either purchased sites or have made reservations in their planning schemes.

So often one finds that a local aerodrome scheme is a source of political axe-grinding, and the idea progresses (or not) according to the particular colour of the flag flying on the council house battlements at the time. Furthermore, the local airport committee consists almost invariably of people with no knowledge at all of the various problems involved. Hence the Airports Exhibition and Conference, which is designed to give these committee men some idea of airport design and of the equipment which is necessary for an airport's successful use.

Going Abroad

Until comparatively recent times Britain's contribution to European air transport was made solely by Imperial Airways. Apart from the operators of a few special seasonal services to the French and Belgian coastal resorts, no other transport firm tempted the gods until the late Mr. Edward Hillman started his Paris service and showed that it was possible to charge similar, or even lower, fares without the assistance of a subsidy, provided that running costs were considered in the choice of the machines used.

Now, however, British Airways, a merger company based on the original Hillman's Airways, run services not only to Paris but to the Scandinavian countries and to Lille. During last year this company obtained the mail contract to Copenhagen, Malmo and Stockholm, and have since operated a daily service for passengers in addition to a night mail over part of the distance. At the same time, British Continental Airways were running a similar daylight service, but, after the provisional merger arrangements had been made between the two companies, only one daily service was run, and British Airways also took over the Lille run, which was originated by B.C.A.

Last year, too, B.A. took over Mr. Leo Crilly's Portuguese plans, but these naturally remain in abeyance during the period of the civil war in Spain, and were by no means complete when this war put an end to the negotiations. In the map on this page the Bordeaux, Madrid and Seville route is shown as the first part of the company's projected West African and South American service, but there is no other reason to suppose that the service will eventually use this route. Work is going on in planning the necessary details for this long-distance service, but no tender has yet, to our knowledge, been accepted by the Air Ministry.

Last year, B.C.A., in collaboration with K.L.M., the Dutch company, ran a service between Liverpool, Doncaster and Amsterdam, and next year Aberdeen Airways propose to fly across the North Sea to Norway.

Meanwhile, the regrettable train journey in the passengers' travels by Imperial Airways to Africa, India and Australia has been shortened during the past fortnight. The Mediterranean flying-boat is now boarded at Marseilles instead of Brindisi, and eventually, it is to be supposed, long-distance passengers will fly all the way. Each Empire boat will leave Hythe or Langstone Harbour and fly across France to Marseilles, alighting at two suitable points on the way. The provisional refuelling points are at Caudebec on the Seine and Mâcon on the Saône. For the past year or more Imperials have been operating a twice-weekly landplane service between London, Marseilles, Rome and Brindisi. H. A. T.

Durban Air Display

AN outstanding event in South Africa during the "Mail Week" celebrations was the air pageant held under the patronage of the Minister of Defence, Mr. O. Pirow. A crowd of nearly 40,000 came to the Durban aerodrome to see many different types and sizes of aircraft and some of South Africa's most distinguished pilots, including Captain S. S. Halse.

Two aircraft new to South Africa, the 80 h.p. and 100 h.p. Bücker Jungman, were demonstrated by two German ex-War pilots, Herr Willie Rosenstein and Herr Katzenstein.

The Kirby Kite sailplane in which Mr. Phillip Wills established a South African record was another attraction.

During a display of high-speed aerobatics two Hawker Furies collided in the air. The airscrew of one hacked its way through the top wing of the other, but the pilots retained complete control, however, and landed without mishap.

The display was held to mark the conclusion of locally inspired flying scholarships, for which 260 competed.

The most advanced civil aircraft yet in service : the peerless Short Empire flying boat with four Bristol Pegasus XC engines.

BRITISH COMMERCIAL AIRCRAFT

The Current Range Reviewed

(Illustrated mainly with "Flight" photographs)

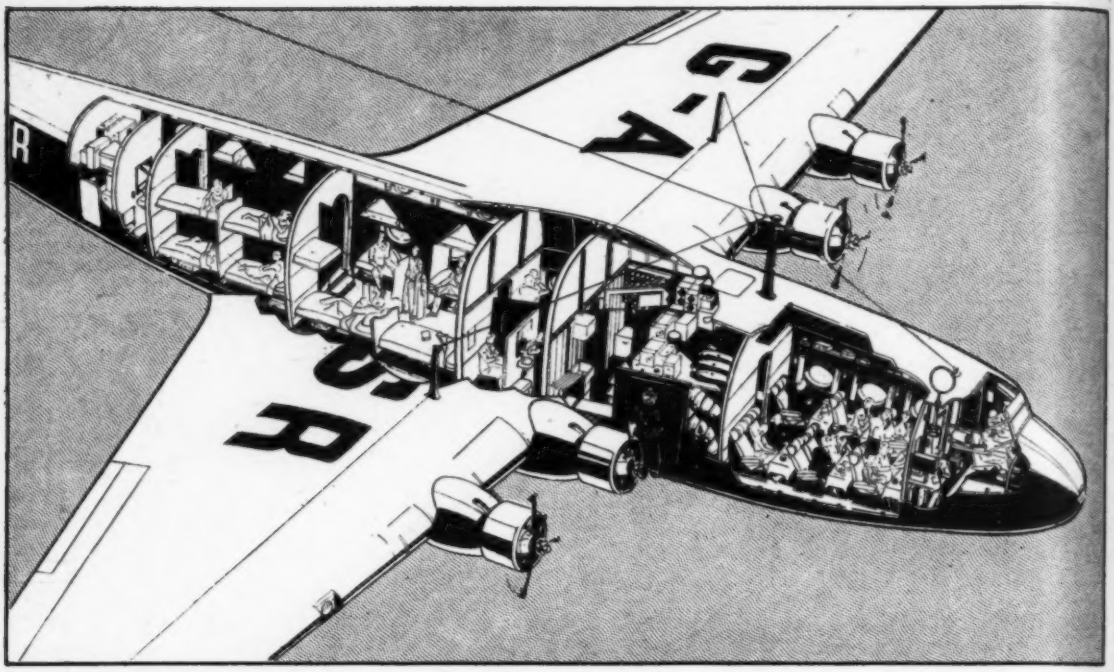
FOR the time being the British commercial aeroplane types available to operators are comparatively few in number (due, chiefly, to the demands of R.A.F. expansion) but as excellent as ever in quality. That there are gaps in the range is not to be disputed, but, on the other hand, Great Britain is building machines for certain types of commercial work the equals to which are not to be found abroad.

The following notes indicate the main characteristics and scope of current types and their capabilities in the commercial field.

AIRSPEED

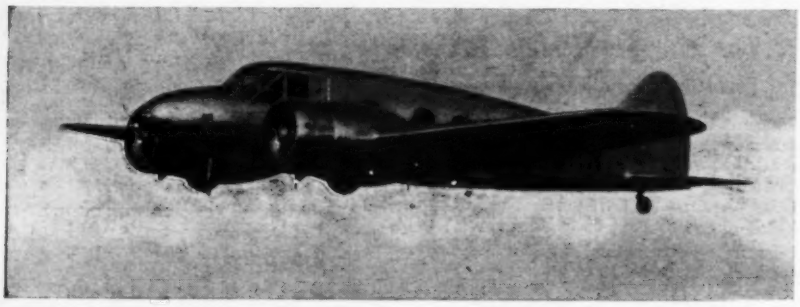
ONE of the fastest machines of its type in the world is the Airspeed Envoy Series III transport monoplane now in production at the Portsmouth airport. Any one of a variety of cabin arrangements may be specified, the accommodation ranging from four luxurious seats with tables, a lavatory and ample luggage space, to an eight-seater cabin, also with a luggage compartment.

On the left is an Airspeed Envoy fitted with Siddeley Cheetah IX engines in which form it is capable of 205 m.p.h. The single-engined monoplane on the right, seen with undercarriage lowered, is the Lynx-engined Courier.



An idea of the spaciousness of the internal accommodation of the A.W.27 machines for Imperial Airways is given by this cut-away drawing.

Of wooden construction, the Series III Envoy is a twin-engined cantilever low-wing monoplane with an undercarriage which retracts into the engine nacelles. A large range of engine installations is available, the following being typical examples: Siddeley Cheetah IX, Wright Whirlwind R.760.E.11 (American), Gnôme Rhone K7 (French) or Walter Castor II (Czechoslovakian). Fixed pitch airscrews of either metal or wood are fitted as standard, but V.P. screws may be specified if the engines used are suitable.



An Avro 652 used by Imperial Airways. A later version is now available.

It is possible to install wireless, which can be operated by remote controls from the pilot's cockpit. Alternatively, if a navigator/wireless operator is carried, the wireless is controlled from his special seat.

With Cheetah IX engines a maximum speed of 205 m.p.h. is obtainable at 7,300 ft., the cruising speed at 62.5 per cent. maximum power being 175 m.p.h. at 10,000 ft. Efficient trailing edge flaps give a stalling speed of 64 m.p.h. The take-off run is 210 yards and the service ceiling 22,000 ft.

A second Airspeed model suitable for commercial operation is the Courier, a single-engined monoplane on somewhat similar lines to the Envoy. With a Siddeley Lynx IVC engine (the Cheetah is an alternative installation) the Courier reaches a maximum speed of 153 m.p.h. and carries a disposable load of 1,556 lb.

Designs were prepared some time back for a high-wing monoplane with two Bristol Pegasus X engines.

Makers: Airspeed (1934), *Ltd., The Airport, Portsmouth.*

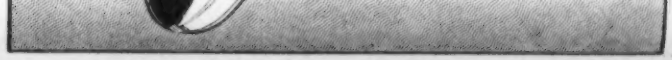
ARMSTRONG WHITWORTH

PROFITING by the experience gained by the construction of the *Atalanta* class of four-engined monoplanes and their subsequent operation by Imperial Airways, Sir W. G. Armstrong Whitworth Aircraft, Ltd., is building a fleet of much larger machines of advanced design for the same company.

Bearing the Armstrong Whitworth works number A.W.27 and known to Imperial Airways as the *Ensign* class, the new machines will be produced in two forms, one with accommodation for thirty-two passengers (European class) and the second (Empire class) for twenty-seven passengers by day, or twenty, with sleeping accommodation, by night. Both models will have a steward's pantry, and in the European class there will be three lavatories, the Empire class having two.

The fuselage is an oval monocoque structure with stressed skin covering. In the extreme nose is the control room accommodating the captain, first officer and wireless operator, and aft of this the

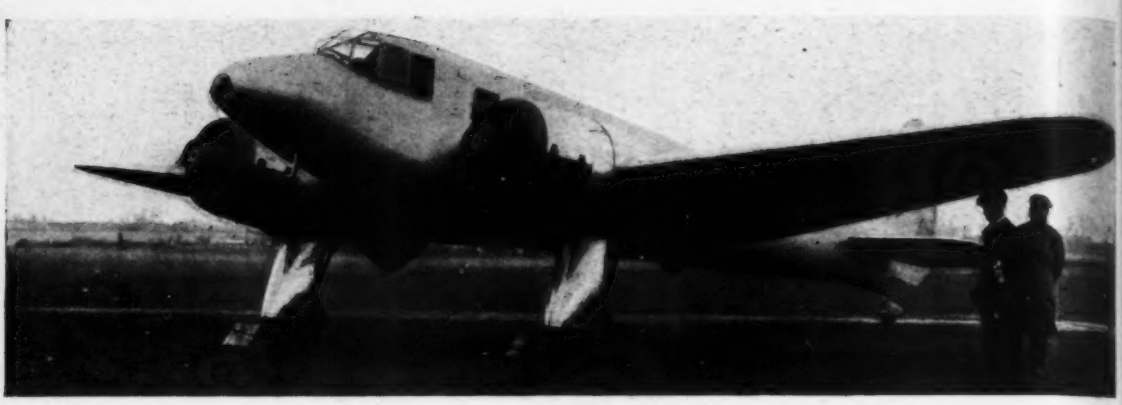
Striking in design and brilliant in performance: the B.A. Double Eagle.



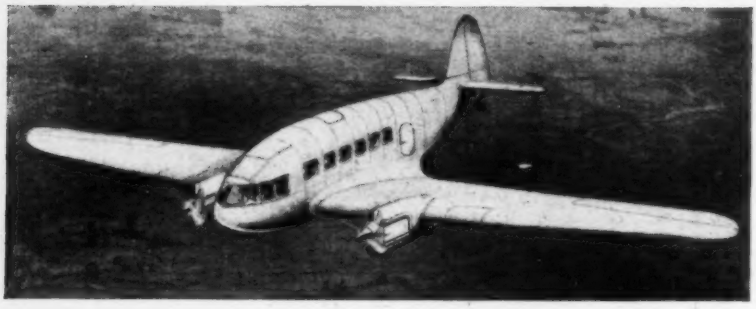
MODERN COMMERCIAL AIRCRAFT and THEIR ENGINES

	Name of Aircraft.	Aircraft Type.	Weight Empty.	Total Weight	Max. Speed.	Cruising Speed.	Normal Range.	Service Ceiling.	Engine(s) and Type.	Max. Power.	Rated Power.	Fuel Consumption (normal) per engine, and Octane No.	
			lbs.	lbs.	m.p.h.	m.p.h.	miles	feet		h.p.	h.p.	Fuel.	Oil.
1	Airspeed Courier	4–5 pass. L.W.M. ...	{2,250 {2,328	3,900 4,000	153 165	132 145	635 535	13,500 17,000	Armstrong Siddeley :— 1 Lynx IVc, 7 R.A. ... ... 1 Cheetah V, 7 R.A.	240 306	210 275	(77) 12.4 gal./hr. (77) 41.1 gal./hr.	2½–6½ pt./hr. 4–8 pt./hr.
2	Airspeed Envoy III ...	8 pass. L.W.M. ...	4,325	6,400	205	175	650	22,000	2 Cheetah IX, 7 R.A.	350	310	(87) 13.8 gal./hr.	4–8 pt./hr.
3	Avro 652	6 pass. L.W.M. ...	5,100	7,500	195	165	760	21,500	2 Cheetah IX, 7 R.A.	350	310	(87) 13.8 gal./hr.	4–8 pt./hr.
4	Armstrong Whitworth 27 ...	42 pass. H.W.M. ...	—	—	200 (apprx.)	—	—	—	4 Tiger IX, 14 R.A.	804	790	(87) 35 gal./hr.	6–8 pt./hr.
5	B.A. Double Eagle	6 pass. H.W.M. ...	{2,000 {2,450	3,500 4,300	165 200	145 165	510 600	17,000 19,000	2 D.H. Gipsy Major, 4 I.L.A. ... 2 D.H. Gipsy Six I, 6 I.L.A. ...	130 200	120 185	(70) 8½ gal./hr. (70) 9½ gal./hr.	1¾ pt./hr. 1–4 pt./hr.
6	Blackburn H.S.T.10 ...	10 pass. L.W.M. ...	5,490	8,850	200	175	600	22,000	2 Napier Rapier VI, 16 H.A....	395	360	(87) 17½ gal./hr.	5–10 pt./hr.
7	Bristol 143	8 pass. L.W.M. ...	—	—	—	—	—	—	2 Bristol Aquila, 9 R.A. ...	500	420	(73)	
8	D.H. Dragon (84)	5–8 pass. Biplane ...	2,385	4,500	128	109	545	15,000 (abs.)	2 D.H. Gipsy Major, 4 I.L.A. ...	130	120	(70) 8½ gal./hr.	1¾ pt./hr.
9	D.H. Express (86A) ...	10–16 pass. Biplane	{6,861 {7,021	10,250 11,000	166 —	141 152	452 —	17,400 18,300	4 D.H. Gipsy Six I, 6 I.L.A. ... 4 D.H. Gipsy Six II V.P., 6 I.L.A.	200 205	185 up to 205	(70) 9½ gal./hr. (77) 11½ gal./hr.	1–4 pt./hr. 3–5 pt./hr.
10	D.H. Rapide (89)	5–8 pass. Biplane ...	3,100	5,500	155.5	132	573	16,700	2 D.H. Gipsy Six I. 6 I.L.A. ...	200	185	(70) 9½ gal./hr.	1–4 pt./hr.
11	D.H. Rapide Seaplane (89)...	5–8 pass. Biplane ...	3,400	5,500	145	123	534	—	2 D.H. Gipsy Six I, 6 I.L.A. ...	200	185	(70) 9½ gal./hr.	1–4 pt./hr.
12	D.H. Dragonfly (90) ...	4 pass. Biplane ...	2,520	4,000	147	130	885	15,700	2 D.H. Gipsy Major, 4 I.L.A. ...	130	120	(70) 8½ gal./hr.	1¾ ft./hr.
13	D.H. Albatross (91) ...	— L.W.M. ...	—	25,000	250 (apprx.)	—	—	—	4 D.H. Gipsy Twelve V.P., 12I V.A.	over 500			
14	Heston Phœnix	5 pass. H.W.M. ...	2,120	3,300	148	125	500	15,500	1 D.H. Gipsy Six I, 6 I.L.A. ...	200	185	(70) 9½ gal./hr.	1–4 pt./hr.
15	Mayo (Upper component) ...	Mail Carrier H.W.M.	9,760	20,000	—	160	3,380	—	4 Napier Rapier V, 16 H.A. ...	340	315	(87) 17½ gal./hr.	5–10 pt./hr.
16	Miles Peregrine	6 pass. L.W.M. ...	3,200	5,500	180	160	562	23,000 (abs.)	2 D.H. Gipsy Six II V.P., 6 I.L.A.	205	up to 205	(77) 11½ gal./hr.	3–5 pt./hr.
17	Monospar S.T.25	5 pass. L.W.M. ...	1,758	2,875	—	123	496	12,000	2 Pobjoy Niagara, 7 R.A. ...	88	95	(70) 5 gal./hr.	1.5 pt./hr.
18	Monospar Croydon (S.T.18)	10 pass. L.W.M. ...	8,000	11,350	203	190	630	19,500	2 Pratt and Whitney Wasp Jr. V.P., 9 R.A.	Take off 450	400	(87) .48 lb./h.p./hr.	.038 lb./h.p./hr.
19	Pobjoy Short Scion... ...	5 pass. H.W.M. ...	2,125	3,200	122	107	370	11,500	2 Pobjoy Niagara, 7 R.A. ...	88	95	(70) 5 gal./hr.	1.5 pt./hr.
20	Short Scion Senior	9 pass. H.W.M. ...	3,652	5,750	145	122	420	13,000	4 Pobjoy Niagara, 7 R.A. ...	88	95	(70) 5 gal./hr.	1.5 pt./hr.
21	Scion Senior Seaplane ...	9 pass. H.W.M. ...	4,058	5,750	135	115	400	10,000	4 Pobjoy Niagara, 7 R.A. ...	88	95	(70) 5 gal./hr.	1.5 pt./hr.
22	Short Empire Boat ...	16–24 pass. H.W.M.	23,500	40,000	200	160	730	20,000 (abs.)	4 Bristol Pegasus Xc V.P., 9 R.A.	830	815	(87)	
23	Scottish Aircraft	14 pass. H.W.M. ...	9,327	15,000	245	216	750	22,000	2 Rolls-Royce Kestrel XVI V.P., 12 V. W.	745	690	(87) 33 gal./hr.	6 pt./hr.

Abs. = Absolute ceiling. I. = Inverted. L. = In-line. A. = Air-cooled. W. = Liquid cooled. V. = Vee formation. R. = Radial. H. = H formation. L.W.M. = Low-wing monoplane. H.W.M. = High-wing monoplane. V.P. = Variable pitch airscrew.

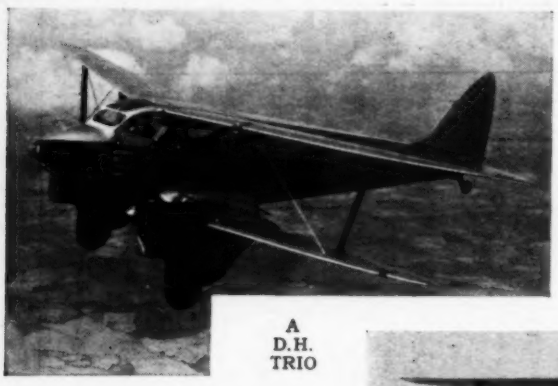


Two civil-rated Aquila sleeve-valve engines power the businesslike Bristol 143 transport monoplane.



The preliminary symbols in the designation of the Blackburn H.S.T.10 indicate "high-speed transport." The engines are sixteen-cylinder Napier Rapiers.

fuselage is divided up into separate cabins, there being four in the European and three in the Empire class. Mails and baggage are stowed in a hold on the upper deck of the middle compartment.



A D.H. TRIO

The small twin-engined biplane above is the Dragonfly (two Gipsy Majors); (top right) a machine of the 86 series (four Gipsy Sixes) belonging to Qantas Empire Airways; and (lower right) a Rapide (two Gipsy Sixes) operating on skis.

Four moderately supercharged Armstrong Siddeley Tiger IX 14-cylinder two-row radials are mounted forward of the leading edge of the high monoplane wing, the wheels of the undercarriage retracting into the nacelles behind the inboard engines. Trailing edge flaps and D.H. variable pitch airscrews are specified.

The main data are: Span 123 ft., length 110 ft., gross weight 45,000 lb., and maximum speed approximately 200 m.p.h.

Makers: Sir W. G. Armstrong Whitworth Aircraft, Ltd., Coventry.

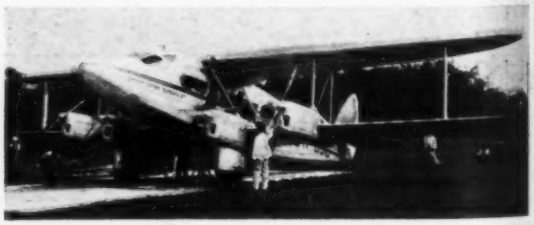
AVRO

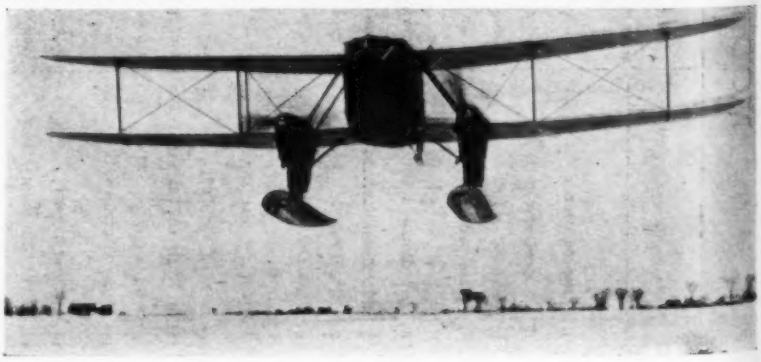
ALTHOUGH at the moment R.A.F. expansion is demanding most of the Avro Company's attentions, the development of the 652 commercial monoplane has not been abandoned. In fact, a number of refinements incorporated in the Anson military monoplane (a development of the original 652 design) are being specified for the latest commercial model of the 652.

Features of the new type are an improved tail and modified engine nacelles and cowlings.

Structurally the machine has a welded steel tube fuselage and wooden wing. The two engines are Siddeley Cheetah IXs which can drive fixed- or variable-pitch airscrews. The wheels of the undercarriage retract into the nacelles behind the engines.

At 6,000 ft. a maximum speed of about 195 m.p.h. is





attainable, the cruising and landing speeds being 165 m.p.h. and 62 m.p.h. respectively. Ranges up to 760 miles are available, according to the seating required. Lavatory and baggage accommodation are included.

Makers: A. V. Roe and Co., Ltd., Newton Heath, Manchester.

BLACKBURN

DURING the past year the Blackburn Company was testing a high-speed transport monoplane known as the H.S.T.10, but production of this model has been retarded by an influx of Government orders in connection with the R.A.F. expansion scheme.

Incorporating a Blackburn-Dunscanon single-spar wing (the spar is used for fuel storage) the H.S.T.10 is a low-wing cantilever monoplane of completely modern design fitted with a pair of Napier Rapier VI 16-cylinder H-type engines and retractable undercarriage. The cabin can be arranged to seat up to twelve passengers. A maximum speed of 204 m.p.h. is attainable at 5,500 ft

Makers: Blackburn Aircraft, Ltd., Brough, East Yorks.

BRISTOL

INUNDATION by Government orders has precluded the large-scale production of civil aircraft by the Bristol Company, although an extremely promising prototype has been built. This is the type 143 monoplane with twin Aquila sleeve-valve engines. The 143 is similar in general layout to the 143 *Britain First* presented by Lord Rothermere to the R.A.F., which was capable of something like 280 m.p.h. It has a retractable undercarriage and flaps and measures 56 ft. 6 in. in span. A detailed description is not permissible because of the resemblance of the machine to the Blenheim high-speed medium bomber now in production for the British Air Ministry.

Makers: The Bristol Aeroplane Co., Ltd., Filton, Bristol.

BRITISH AIRCRAFT

IT is somewhat difficult to define the wing arrangement of the B.A. Double Eagle high-speed light transport monoplane. It is, perhaps, best described as a three-quarter high-wing semi-cantilever type, the inner sections of the wing being given an anhedral angle and being braced by appropriate lift struts.

The pilot is in the nose of the well-streamlined fuselage and is separated by a bulkhead from the cabin, which has a capacity of 204 cu. ft. and is lit by six windows.

Double Eagles have already been built with twin Gipsy Major and twin Cipsy Six engines, the maximum speeds being 165 m.p.h. and 200 m.p.h. Doubtless the new D.H. Series II Gipsy Sixes with V.P. airscrews would increase performance very considerably. For the "Major"-engined version the disposable load is 1,500 lb. and with a pair of Series I Gipsy Sixes 1,850 lb. It is possible to fly a Double Eagle on one engine and maintain an altitude of 5,000 ft. with a single Gipsy Major and 7,500 ft. with one Gipsy Six.

The wheels of the undercarriage retract into the engine nacelles.

Makers: The British Aircraft Manufacturing Co., Ltd., Hanworth Aerodrome, Feltham, Middlesex.

Eminently suitable for charter operation is the Heston Phœnix with a D.H. Gipsy Six engine.

The new Miles Peregrine light transport monoplane (two Gipsy Six II) is seen on the right with its retractable undercarriage lowered.

The Miles Merlin, a "charter" type with Gipsy Six engine.

COMPER

A NEW type of civil aircraft known as the Comper Commerce is to be built by Comper Aeroplanes, Ltd., of 86, Strand, London, W.C.2. A second machine, the Dominion, is designed specially for overseas conditions.

C.W.

A TWIN-ENGINED monoplane suitable for charter and feeder line work has been designed by C-W. Aircraft, Montrose Avenue, Trading Estate, Slough. This machine has been planned to take two Villiers-Hay Mayas of either the present standard type or of a new design offering 170 h.p.

As seen above, the Monospar Croydon is fitted with two American Pratt and Whitney Wasp Junior engines, but various other power plants are available. Below, on the right, is the smaller Pobjoy-engined Monospar S.T.25.

DE HAVILLAND

THE eyes of commercial operators and, for that matter, designers, the world over are turning towards Hatfield aerodrome where the ninety-first De Havilland aircraft type will shortly be making its appearance. Christened the Albatross, the new machine is a large low-wing cantilever monoplane with four of the recently developed De Havilland Gipsy Twelve inverted-vee air-cooled engines driving D.H. v.p. airscrews. Loaded to 25,000 lb. the Albatross, which will be used in the first instance for experimental transatlantic flying, will reach a maximum speed in the neighbourhood of 250 m.p.h.

The largest D.H. machine at present in production, the popular 86a, is about half the size of the Albatross and is a biplane with four 200 h.p. Gipsy Six engines (which may be of Series I or Series II design) built into nacelles on the lower wings. The 86a is of wooden construction and accommodates from ten to sixteen passengers. Using Series II "Sixes" and variable-pitch airscrews its continuous operating speed at 7,000 ft., when loaded to 10,250 lb., is 152 m.p.h., and the absolute ceiling 20,500 ft. With two engines out of action it can maintain a height between 2,500 and 4,500 ft., according to combination.

Virtually a small 86, the Rapide has two Gipsy Six engines and carries a disposable load of 2,400 lb. at a cruising speed of 132 m.p.h. for 573 miles. Like the highly successful Gipsy Major-engined Dragon (which is still being supplied to various commercial operators) the Rapide can be used as a seaplane or fitted with skis.

The Dragonfly is a smaller and later machine with two Gipsy Majors and tapered wings of unequal span. A maximum speed of 147 m.p.h. is attainable and ranges of 625-885 miles are well within its capabilities. Five seats are normally fitted.

Makers: The De Havilland Aircraft Co., Ltd., Hatfield, Herts.

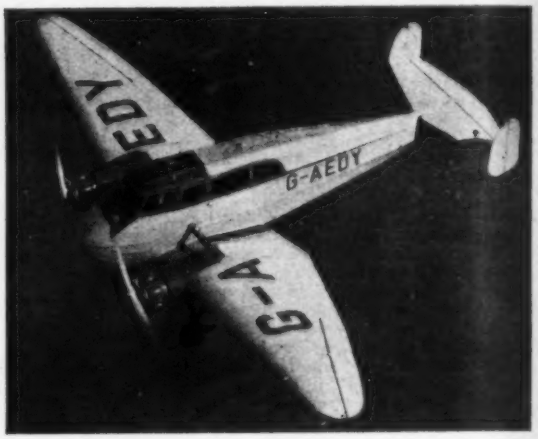
HANDLEY PAGE

THE greatest achievement of this firm in commercial aviation was the construction of a series of large four-engined biplanes for the Continental and Empire services of Imperial Airways. By 1936 these machines had flown collectively about five million miles. There is no current H.P. civil type, but the reputation of the H.P. 42s is testimony to the firm's skill.

Makers: Handley Page, Ltd., Cricklewood, London, N.W.2.

HESTON

IT is probably to operators of charter aircraft that the Heston Phœnix will chiefly appeal in the commercial field, for economy and adaptability are two of its many strong features. Arranged as a high-wing strut-braced monoplane, the machine is a five-seater and has a retractable undercarriage which folds into a stub wing. Structurally the machine is of wood and is powered with a single D.H. Gipsy Six engine which may be of the Series I or Series II variety. With the earlier engine a maximum speed of 148 m.p.h. is attainable and the machine will cruise at 125 m.p.h. for 500 miles.



It is estimated the Phœnix when fitted with the Series II Gipsy Six engine and two-position De Havilland airscrew will show the following improvements in performance as compared with the present model: Take-off reduced from 250 yd. to 200 yd., rate of climb increased from 700 ft./min. to 850 ft./min., cruising speed increased from 125 m.p.h. to 135-140 m.p.h. at 6,000 ft. Range will remain as at present, consumption cancelling out higher extra speed.

Makers: The Heston Aircraft Co., Ltd., Heston Airport, Hounslow, Middlesex.

MILES

ONE of the most interesting machines produced in this country last year was the Miles Peregrine light transport monoplane. This is the first multi-engined model to be built by Phillips and Powis Aircraft, Ltd., and although much larger than any previous Miles machine, it incorporates a number of features popularised by the earlier models. The structural system employed is similar and Miles split trailing edge flaps are fitted.

The prototype Peregrine is powered with two De Havilland Series II Gipsy Six engines driving two-position airscrews giving a maximum speed at sea level of 180 m.p.h. and a

A particularly attractive proposition for fast charter work is the Percival Vega Gull fitted with a D.H. Gipsy Six engine.

The Scion (right) is of Short design and Pobjoy manufacture and is powered with two Niagara radials.

cruising speed of 160 m.p.h. The Peregrine lands with flaps down at 52 m.p.h., climbs to 16,000 ft. in 21½ min., and has a range at cruising speed of 562 miles.

The soundproofed cabin is normally arranged to seat six passengers and there is accommodation for a crew of two in the nose.

Alternative power plants will eventually be supercharged Menascos of the B6S series, which offer a maximum speed of 194 m.p.h. and a cruising speed of 172 m.p.h.

A single-engined machine of somewhat earlier design, the Miles Merlin, has a Gipsy Six engine and carries four passengers at a cruising speed of 140 m.p.h.

Makers: Phillips and Powis Aircraft, Ltd., Woodley Aerodrome, Reading, Berks.

MONOSPAR

THANKS to clever aerodynamic and structural design, the Monospar Croydon (model S.T.18) is able to carry a crew of two and ten passengers with their baggage at a cruising speed of 190 m.p.h. (72 per cent. power) for 630 miles, with two engines developing 400 h.p. each.

The Croydon is of distinctive appearance, being a low-wing cantilever monoplane with a very pronounced sweep-back outboard of the engine nacelles into which the undercarriage is arranged to retract. The pilots' compartment is in the nose and has side-by-side seating and dual controls. It is possible to install wireless immediately behind the pilot's seat.

Pratt and Whitney Wasp Junior radials driving two-position airscrews were specified for the prototype Croydon, but a variety of other power plants is available, including the Bristol Aquila and, where extreme performance is desired, the Mercury.

A popular type for charter and feeder line work is the Monospar S.T.25 with two 90 h.p. Pobjoy Niagara III radials. This model, a five-seater, cruises at 123 m.p.h. and has a range of nearly 500 miles.

Makers: General Aircraft, Ltd., The London Air Park, Feltham, Middlesex.

PERCIVAL

ONE of the most attractive propositions for high-speed charter work available to-day is the Percival Vega Gull four-seater. A cantilever monoplane with well faired fixed undercarriage, the Vega can be supplied either with the Series I or Series II D.H. Gipsy Six engine, the cruising speeds respectively being 150 m.p.h. and 158 m.p.h.

The two front seats are provided with dual controls and there is a large locker for baggage immediately behind the rear seats with access from the outside.

The range with standard tankage is no less than 630 miles (Gipsy Six I). Split trailing edge flaps permit operation from confined spaces.

Makers: Percival Aircraft, Ltd., 20, Grosvenor Place, London, S.W.1.

The Short Scion Senior (four Pobjoy Niagaras) is shown above as a landplane.

POBJOY

THE Pobjoy-Short Scion now in production at Rochester is capable of carrying a disposable load of 1,000 lb. at a cruising speed of 116 m.p.h. when fitted with two Pobjoy Niagaras of 90 h.p. each (maximum).

Arranged as a high-wing cantilever monoplane the Scion can be operated as a land or sea plane, and normally accommodates five passengers, although an additional seat can be fitted to order. The pilot has an enclosed cockpit in front of the leading edge of the wing.

Metal construction is employed, the covering being of fabric.

As a landplane the Scion is capable of 128 m.p.h. and lands at 50 m.p.h. taking a run, with brakes of 140 yd., which is about the same as the take-off run in a 5 m.p.h. wind. The substitution of a float undercarriage for the wheels decreases the maximum speed by 6 m.p.h. and the range by 20 miles. In a 5 m.p.h. wind the Scion seaplane takes off in 22 sec.

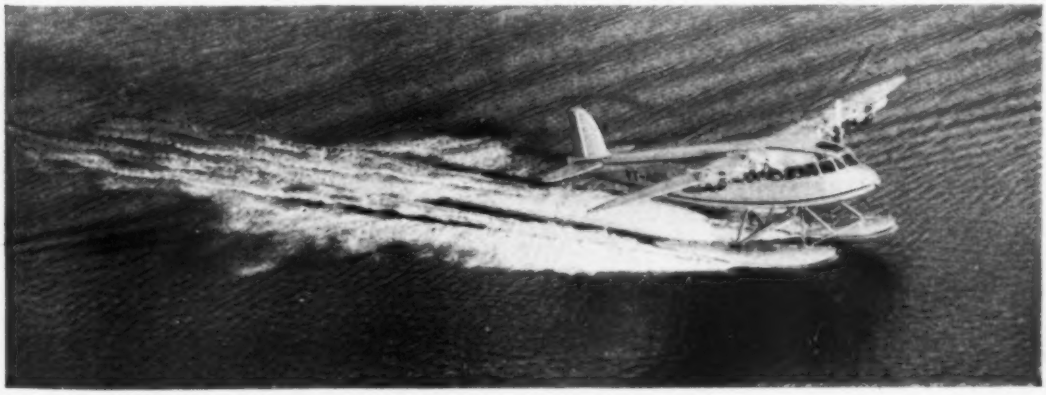
Makers: Pobjoy Airmotors and Aircraft, Ltd., Rochester, Kent.

SAUNDERS ROE

A NUMBER of Cloud and Cutty Sark flying boats and amphibians have been used for commercial work during the past few years, but their manufacturers, Saunders Roe, Ltd., of East Cowes Isle of Wight, are now concentrating on Service types.

SCOTTISH

THE Burnelli (lifting fuselage) type of aircraft originally conceived in America offers a number of advantages for com-



The seaplane version of the unique Short Scion Senior has a maximum speed of 135 m.p.h.

mercial work. For example, the fuselage of the machine now being built under licence from the Burnelli concern by the Scottish Aircraft and Engineering Co., Ltd., has a passenger cabin 12 ft. wide. The engines specified for this model are two fully supercharged Rolls-Royce Kestrel XVIs which enable 14 passengers, two pilots and 1,000 lb. of mail to be carried at a maximum speed of 245 m.p.h.

A special freighter machine built on the Burnelli principle has been designed.

Makers: Scottish Aircraft and Engineering Co., Ltd., Shell-Mex House, Strand, London, W.C.2.

SHORT

EPITOMISING the excellence of modern commercial British aircraft the Short Empire flying boat is probably the most successful large marine aircraft yet built. Twenty-eight of these machines have been ordered for the Empire routes of Imperial Airways. The Empire boat is a cantilever monoplane with four Bristol Pegasus Xc radials which give a maximum speed of 200 m.p.h. at 5,500 ft. By day, twenty-four passengers are accommodated in four cabins, and for night operation there are sleeping arrangements for sixteen. The hull has two decks, the upper and lower respectively housing the crew and freight and the passengers.

A machine of somewhat similar design to the standard Empire boat will form the lower component of the Short-Mayo composite aircraft, which is virtually a large flying boat carrying on its back a small heavily loaded twin-float seaplane which would normally be incapable of rising from the water with safety. On reaching a given height the two machines separate, the upper component then being capable of an extremely long range with a fair payload.

Four fully supercharged Napier Rapier H-type engines are being specified for the upper component (christened *Mercury*) which is now nearing completion at Rochester.

Makers: Short Bros. (Rochester and Bedford), Ltd., Rochester, Kent.

AGENCIES FOR FOREIGN AIRCRAFT

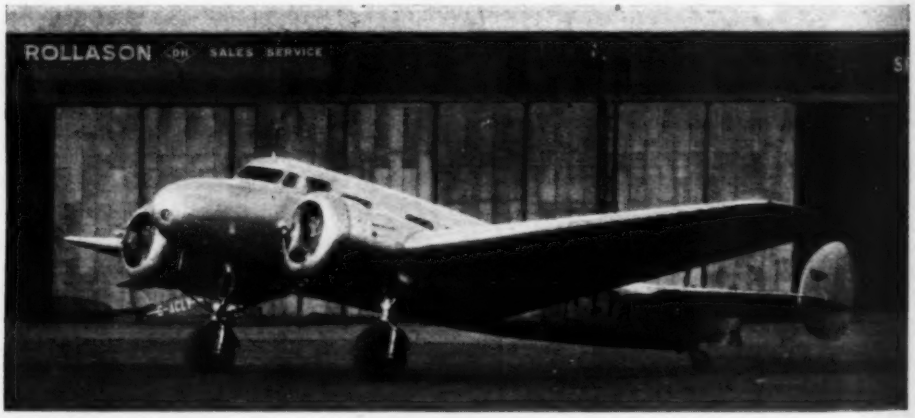
THREE prominent Croydon companies, Surrey Flying Services, Ltd., Rollason Aircraft Services, Ltd., and Brian Allen Aviation, Ltd., are introducing some outstanding American aircraft to the European market.

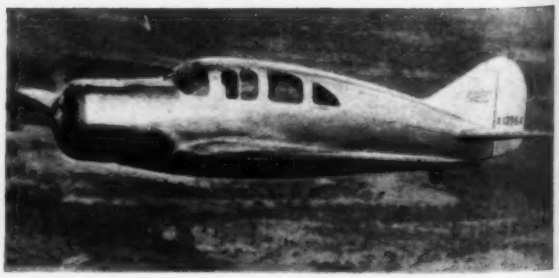
"Surreys" are handling the Cessna C.34 high-wing cantilever monoplane which carries four people at a cruising speed of 143 m.p.h. for a consumption of less than 7½ gal./hr. and costs £1,375; the Beechcraft models, the most widely used of which is the C.17, which, with 420 h.p. Wright Whirlwind (Model C.17R) does 202 m.p.h.; the Spartan Executive (a four-five-seater capable of 208 m.p.h. with 420 h.p. Wright); and the Fleetwings Sea Bird four-seater amphibian of stainless steel shot-welded construction.

Rollasons have acquired the agency for Lockheed types, the most popular of which, at the moment, is the Electra, a ten-passenger monoplane powered with Wasp Juniors or Whirlwinds, and capable of over 200 m.p.h. A smaller, newer and faster type is the Lockheed "12," which accommodates six passengers and cruises at 213 m.p.h. The Lockheed Super Electra, now building in the U.S.A., is much larger than either the Electra or "12," and is estimated to be capable of carrying twelve passengers at speeds up to 250 m.p.h.

Brian Allen Aviation, Ltd., are handling Stinson machines fitted with Lycoming engines. The most extensively used Stinson model is the Reliant high-wing monoplane, the latest version of which has gull-type wings. With the 225 h.p. Lycoming the Reliant carries pilot, three passengers and 70 lb. of baggage for 400 miles at 137 m.p.h. The three-engined Stinson Model A cruises at 162 m.p.h. with eight passengers, and the Model B (two 260 h.p. Lycomings), seats six passengers and carries them at a cruising speed of 160 m.p.h. for 900 miles.

The *Flight* photograph (right) is of a Lockheed Electra, the agents for which are Rollason Aircraft Services. Below, are (left) the Stinson Reliant, handled by Brian Allen Aviation, and the Spartan Executive, for which Surrey Flying Services are the concessionaires.





Aerofilms Move In

AEROFILMS, LTD., have now moved into their new premises at Beresford Avenue, Wembley, Middlesex, as forecast in *Flight* of December 10. A library of 50,000 air views is housed at their London office at Bush House, Aldwych, W.C.2.

Sywell Opportunities

IT is suggested that Sywell Aerodrome, Northants, would be an excellent centre for aircraft manufacture. It is centrally placed, well distant from any coast. There are suitable flat sites with power and water available, while a large population surrounding should provide ample labour.

AIRPORT CONSTRUCTION and EQUIPMENT

A Guide to the Exhibits at the Exhibition and to Airport Equipment Generally

IN each section in the following pages the Airports Exhibition exhibitors are dealt with first, alphabetically, a stand number identifying them. Each section then concludes, again alphabetically, with a review of non-exhibiting firms' equipment. Where a firm's products would come under more than one heading, a cross reference is given. The definition of "Airport equipment" must of necessity be an arbitrary one, but every effort has been made to make the guide as comprehensive as possible within the space available.

Aerodrome Surface Preparation and Maintenance

The En-Tout-Cas Co., Ltd. (Stand 4).
Construction: *See under Buildings.*

Sutton and Sons, Ltd., The Royal Seed Establishment, Reading (Stand 23).
This firm, which has specialised in turf production for nearly a century, exhibits specimens of turf from seeds, as well as plants of individual varieties. Purity of seeds is exemplified by samples showing typical analyses as carried out at Sutton's seed-testing station.

Samples are on view of the seed as harvested, the pure seed after intensive cleaning, and also the rejected material.

The exhibit includes a type of germinator known as the Copenhagen tank, containing in process of germination various seeds such as are used in the formation of aerodrome turf. Soil tests by the indicator method are also demonstrated.

Edward Webb and Sons (Stourbridge), Ltd., Stourbridge, Worcs. (Stand 1).
This exhibit includes a collection of grass seeds and special fertilisers for aerodromes, and there is an instructive display of desirable and undesirable varieties of grasses, showing their seeds, foliage, and habits of root growth. There are also fertiliser mixtures, manufactured at Webbs' Fertiliser Works, specially compounded for production of aerodrome turf.

The success of Webbs' prescriptions is demonstrated by a collection of turves produced from Webbs' seeds and special fertilisers and taken from the Royal landing ground at Windsor and from various Royal Air Force aerodromes.

Bradshaw Bros. (Contractors), Ltd., Groby Road, Leicester.
Aerodrome preparation in all its aspects is undertaken by the aviation department of this firm, who state that they have laid down ten aerodromes during the past twelve months. They are now continuing work on the Royal aerodrome at Windsor, where they have been responsible for the whole of the work of tree-felling, clearing and levelling.

J. B. Carr, Tettenhall, Staffs.
Specialists in the layout of playing fields, factory sites, etc., this firm also has a well-founded experience of aerodrome construction, and offers free estimates for undertakings of this kind.

Colas Products, Ltd., Norman House, 105-109, Strand, London, W.C.2.
This firm specialises in cold bituminous emulsions for the construction of aerodrome runways, landing ground, hangar aprons and floors, service roads, and car parks.

Specifications range from simple soil stabilisation to bituminous macadam carpets for heavily trafficked runways, etc. The former is a simple process, by means of which the natural surface material is used as the aggregate to form a uniform waterproof landing area free from the mud and dust nuisance. The other specifications are graduated in accordance with traffic demands.

Hunters of Chester (Jas. Hunter, Ltd.), Chester.
This firm are the inventors of the process known as "Hunterising," which produces level, solidly compact, self-draining surfaces. They possess a staff of specially trained and highly skilled workmen, and a battery of soil excavating, levelling, grading, and transporting implements, which, it is claimed, is notable for its perfection of performance and magnitude of scope.

Lloyds and Co. (Letchworth), Ltd., Letchworth, Herts.
This firm are pioncers in the development of gang mowers for aerodrome work, and, by practical trials and experiment, have eliminated all the "snags" found in the early models, and have produced an outfit of very advanced design.

Made of steel throughout, with totally enclosed gears, high-tensile bolts, modern ball bearings, and, last, but by no means least, an efficient anti-choking device, Lloyds' gang mower can be used from the very start of preparing the grass surface.

Ransomes, Sims and Jefferies, Ltd., Ipswich.
This firm is responsible for an extraordinarily wide range of aerodrome preparation and maintenance equipment, which includes graders, ploughs, harrows, mole drainers, ditchers, cable layers, and gang and field mowers.

It is, perhaps, not generally known that these famous agricultural implement manufacturers are also designers and erectors of aerodrome hangars. They also supply the Blackburn tail trolley, which is virtually a power-driven mobile jack for moving heavy aircraft in and out of hangars, etc. The motive power is a flat-twin engine.

Buildings and Building Accessories and Materials

Lewis Berger and Sons, Ltd., Homerton, London, E.9 (Stand 42).
The Berger exhibit consists of panels showing finishes for the decoration of aerodrome buildings and the protection of metalwork, etc., used in their construction. The finishes shown are Pompeian "Save-a-coat" enamel paint; Matroil washable water paint de luxe; Matone flat oil enamel; Bergraph silicate graphite paint; Promeum silver paint ("the paint with the chromium finish"); Ferinium ("the paint-coat-of-mail"); Promeum paint made on a chromate base which gives absolute rust prevention; Ledquid, a famous metal primer; Hardigloss finishing paint; Maisone oil-bound washable water paint; Ace-Synthetic Pompeian enamel paint; Pompeian semi-lustre egg-shell gloss finish; and Surfex, a plastic paint for texture decoration.

Boulton and Paul, Ltd., Norwich (Stand 2).
Owing to Boulton and Paul's long association with the aircraft industry, their structural engineering department is in a particularly favourable position to interpret requirements in connection with the manufacture and the housing of aircraft, and they are showing a series of photographs illustrating some of the work executed, the varied scope of which justifies their claim.

The buildings range from hangars having a clear uninterrupted floor space of 250-ft. span, to the modest building required to house a private aeroplane.

Moreover, the pictures showing work carried out in other countries indicate that their activity is not limited to the British Isles.

Cellon, Ltd., Richmond Road, Kingston-on-Thames (Stand 19).
Featured on this stand are "Cerrux" decorative finishes, comprising a complete range of synthetic painting materials for decorative and protective paintwork, which have wide application in airport buildings, as is indicated by photographs on the stand. The display includes various specimens of paint work effected with these "Cerrux" synthetic materials: Filling primers in grey and red for structural steelwork; white filling primer for wood, metal, brick, etc.; flat undercoatings, gloss and flat finishes; gloss finishes providing a range of permanent blues and greens outstandingly brilliant in colour; satin finish and gloss undercoating; gloss finish in non-yellowing white for interior use; metallic finishes; clear varnishes; pure stainers; stopper in white and grey; and thinners.

Weathered exhibits and photomicrographs of exposure tests complete the exhibit.

The En-Tout-Cas Co., Ltd., Syston, Leicester (Stand 4).
This exhibit consists of an office containing a large number of interesting photographs of aerodromes which have been constructed up and down the country during the past few months. The company specialises in the design, construction and layout of airport buildings and aerodrome surfaces, etc., and, in fact, everything connected with the construction of a modern airport or landing ground. The *Flight* ptotograph on the next page shows the Bristol Aeroplane Company's Reserve School at Yatesbury, which was completely designed and built by this company, which also laid out the aerodrome. The work was carried out during the six worst months of last winter in extremely quick time.

Educational Supply Association, Ltd., Esavian House, 171-181, High Holborn, London, W.C.1 (Stand 22).
The exhibit of the E.S.A. consists of a working model of a hangar fitted with Esavian folding and sliding doors, similar to those erected at Heston Airport, Filton Aerodrome, Bristol, and Speke Aerodrome, Liverpool. These doors are electrically operated.

Full-size doors have been made 200 ft. in length and 35 ft. 8 in. high, and by means of the electrical winding gear can be opened or closed under one minute.

Transparencies showing photographs of Filton and Speke will also be shown and full detailed plans will be on view.

John Hall and Sons (Bristol and London), Ltd., 1-5, King's Road, St. Pancras, London, N.W.1 (Stand 49).
Paints for interior and exterior use on buildings of all kinds are the subject of the display of this firm. The most popular interior paint is "Murac" flat finish, which, as well as having a rich, "live" appearance in spite of its flatness, is claimed to be as hard and easily cleaned as enamel, and to have durability such that the average "Murac"-finished factory interior needs repainting only once every seven years.

Protection of wood and metalwork from weather is offered in a high degree by Hall's "Brolac" exterior paint, which, it is stated, is also highly suitable for machinery.

London and Midland Steel Scaffolding Co., Ltd., Iddesleigh House, Caxton Street, London, S.W.1 (Stand 46).

Embodying in each case the firm's patent "Double-Grip" coupler, steel scaffolding can be applied to an almost endless number of uses, among which may be mentioned the construction of portable buildings, erecting and repair stagings for large aircraft—it is particularly favoured by certain manufacturers of big flying boats—portable storage racks, etc.

Nobel Chemical Finishes, Ltd. (Associated with Imperial Chemical Industries, Ltd.), Nobel House, Buckingham Gate, London, S.W.1 (Stand 30).

Nobel Chemical Finishes, Ltd., are showing a range of decorative finishes for use on aerodrome buildings, such as hangars, office and club rooms, and on equipment such as petrol pumps, lorries, fences and signboards. These include "Dulux" products in glossy, eggshell and flat finishes, for application by brush or spray; "Necol" materials for interior use; and the "Belco" finish, which is similar to the "Belco" used by leading car manufacturers.

A new product of interest for aerodrome buildings is the Nobel alkali-resisting primer, which is recommended for use when it is necessary to paint over unmatured concrete, new lime plaster, cement board or similar materials.

Northern Aluminium Co., Ltd., Bush House, London, W.C.2 (Stand 45).

This stand strikes a practical note in the display of the company's "Noral" aluminium paste. The quality of paints made from this paste is illustrated in a convincing manner by actual use on cement work, steel sections, timber, corrugated iron and fabric.

In all cases a high degree of spectral reflectivity is apparent.

Other points claimed are greater spreading power and opacity, superior resistance to corrosion from high humidity atmospheres, and smoother finish. This last point is stated to reduce to the minimum adhesion of, and corrosion through, atmospheric deposits.

Boston Blacking Co., Ltd., Ulvercroft Works, Leicester.

Bostik, which is claimed to be the only adhesive plus sealing compound that successfully seals windows in cabin machines, performs a corresponding function in the windows of aerodrome buildings. A special grade of Bostik cement secures rubber flooring.

Cellactite and British Uralite, Ltd., Lincoln House, 269-302, High Holborn, London, W.C.1.

Cellactite is a modern alternative to short-lived or breakable media for covering aeroplane hangars.

Being, it is claimed, unbreakable as well as incorrodible, Cellactite—which is an asbestos protected metal—is particularly suitable for sliding door construction, where robustness and lightness are essential.

It is also guaranteed by the makers to last for twenty years, and to be a splendid insulator, thereby saving heat loss within buildings. Further, it is entirely British and is available in large quantities for instant delivery and application.

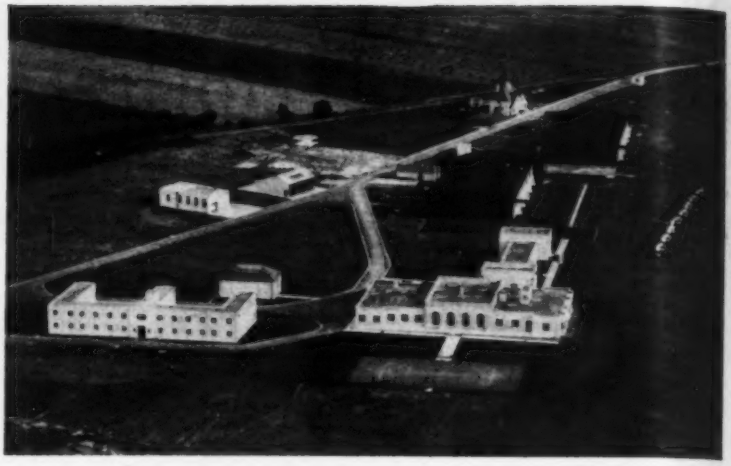
Cement and Concrete Association, 52, Grosvenor Gardens, London, S.W.1 (Stand 30).

The display on this stand will demonstrate the work of the Association in regard to the steadily increasing popularity of concrete in the construction of aircraft hangars and factories.

The Cleveland Bridge and Engineering Co., Ltd., Darlington.

It is reasonable to suggest that a firm which is responsible for such engineering masterpieces as the Lower Zambesi Bridge would have little to learn about large spans in steel; thus it may be taken, apart from the example of the many R.A.F. hangars which they have already erected, that the Cleveland Bridge Company can fulfil all requirements in airport hangar construction.

They design, construct and erect hangars from 50ft. by 50ft. upwards, and these are fitted with easily handled roller-bearing doors.



The whole of the Bristol company's Reserve School at Yatesbury—ground and buildings—has, as related on the previous page, been laid out by the En-tout-Cas Co., Ltd.

Diagrid Structures, Ltd., Horseferry House, Westminster, London, S.W.1.

The "Diagrid" system of construction has advantages of particular value for aircraft hangars. Briefly, "Diagrid" floors or roofs consist of two interlacing sets of diagonal beams, giving a structure of great strength and rigidity. Very large spans can be economically carried out, and the wide door openings required can be arranged without heavy girders.

The structure, it is stated, is highly bomb-proof, as it can suffer without collapse the destruction of individual grid beams. Reinforced concrete or structural steel can be used; in the latter case rolled steel joists suffice for even very large spans, as shown in the photograph which appeared on page 46 of last week's issue of *Flight*.

Arthur L. Gibson and Co., Ltd., Strawberry Vale, Twickenham, Middlesex.

Manufacturers of the Kinnear patent steel rolling shutter, this firm have equipped many large-span aircraft hangars. The outstanding advantage of the rolling shutter, of course, is the fact that it occupies virtually no space when opened. A particularly interesting application of the Kinnear shutter is to the hangars of aircraft carriers.

Hawkes and Snow, Ltd., Shirley, Birmingham

The "Eclair" balancing door has extensive application to aircraft hangars, and the makers are busy with important orders. This type of door pivots about horizontal centres, and a special device ensures that it goes up flush with the lintel when fully opened.

Hawkes and Snow have recently completed such a door 150ft. wide and 40ft. high, in one piece, and so perfectly balanced is it that it can be manually operated by two men, although the actual weight of the door itself is of the order of 60 tons, and the total weight of door and fittings is a matter of 150 tons.

Horseley Bridge and Thos. Piggott, Ltd., Tipton, Staffs.

This firm's "Lamella" roofing construction provides a clear and uninterrupted floor space. Provision is made for future extension and unit construction lends itself to easy transport and speedy erection, mainly by unskilled labour.

The shape of the pressed-steel section is developed to obtain the maximum rigidity. The whole structure is built on the sound principle of the arch, and its strength is stated to be exceptional for the weight of steel employed.

The units are light in weight and nest together compactly for ease and economy in transport.

Robert Kearsley and Co., York Road, Ripon, Yorks.

Kearsley's "Nulac" synthetic resin finishes for aircraft are well known, and among the firm's other products is an extensive range of finishes for indoor and outdoor surfaces of buildings.

Kearsley's have actually supplied finishes for transport vehicles since 1837, their materials being used on such historic systems as the Stockton and Darlington Railway. They thus celebrated their centenary this year, recalling the day when Robert Kearsley, founder of the business, made varnish in a kettle.

A. and A. J. Law, Ltd., 132, Kingston Road, Merton, London, S.W.19.

This firm specialise in steel- and timber-framed hangars and workshops, with brick, asbestos or corrugated iron side walls and asbestos or corrugated iron roofing. Their specially designed hangar doors are claimed to be particularly easy to operate and of pleasing appearance.

For extra large span hangars the firm have a copyright design (type LS), as supplied at Gravesend and Reading aerodromes.

John Lysaght, Ltd., Bristol, 2.

These well-known structural steel experts have erected a number of structures for the manufacture and housing of aircraft, and have recently carried out the extensive extensions at the works of the Bristol Aeroplane Company, as well as hangars at Bristol, Plymouth, Weston-super-Mare and Hamble.

A. and J. Main and Co., Ltd., Vincent Square, London, S.W.1.

This firm has been identified with the design and construction of many important steel-frame hangars.

The whole of the steelwork at Gatwick airport was produced in the Glasgow works of this concern, and this remark applies not only to hangars, but also to the steel required in the "Martello" building and railway station.

A great deal of the work at present being undertaken concerns municipal aircraft accommodation both at home and abroad,

while the firm reports an increasing demand for hangars from private aeroplane owners.

Ransomes, Sims and Jefferies.
Hangars: *See under Aerodrome Surface Preparation.*

Titanine, Ltd., Colindale, London, N.W.9.
Made by this pioneer firm of dope manufacturers, "Lumilac" is designed as a highly efficient coating for hangars, steel structures, and aerodrome buildings.

It is said to combine high covering power and gloss with exceptional durability, while it offers remarkable resistance to brine spray and sea air, and shows toughness, flexibility, and resistance to fatigue. Its speed of drying enables work to be carried out in the minimum time and helps to eliminate the risk of the surface being spoiled through dust settlement.

"Lumilac" in aluminium form is specially recommended for durability outdoors, while for interiors its light reflective properties are of great advantage.

Turner's Asbestos Cement Co., Trafford Park, Manchester, 7.
Asbestos-cement is a versatile material which has been adapted for roofing work in the form of slates, tiles, flat and corrugated sheets. For this purpose "Turnall" Trafford tiles and "Everite" "Bigsix" asbestos-cement corrugated sheets are of outstanding value for the covering of large areas with economy and speed. For the interior decoration of terminal buildings, etc., "Turnall" glazed panels and "Poilite" decorated asbestos-cement sheets are available, whilst "Poilite" rigid rubber floor tiles give a resilient rubber floor surface backed for rigidity with asbestos-cement.

There are also "Everite" rainwater goods, soil and flue pipes which, in common with all the all-asbestos-cement building products, are stated to require no protective painting and are entirely free from maintenance troubles.

Aerodrome and Interior Lighting, Electrical Equipment, Wind Indicators, etc.

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2 (Stand 9).
Mazda lamps of various types required for the lighting of aeroplanes and aerodromes are exhibited on this stand. These lamps can be divided into four categories:—

(1) Low-voltage lamps for interior and instrument lighting on aeroplanes: A range of 12-volt Mazda lamps in various wattages ranging from 12 to 26.

(2) Lamps for landing lights: A special group of low-voltage, high-wattage lamps have been developed for use in landing lights. Four lamps of this type are shown on the stand.

(3) Projector lamps: A representative range of Mazda projector lamps is shown. Particular attention is directed to the line filament lamps.

(4) Mazda Mercra (electric discharge) lamps, which, by reason of their high efficiency, are particularly suitable for the economical lighting of large interiors, such as hangars and aeroplane workshops.

Brown Bros. (Aircraft), Ltd. (Stand 26).
Indoor and outdoor lighting: *See under Workshop Equipment.*

Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C.4 (Stand 14).
Callender's manufacture all types of insulated electric cables for lighting, heating and power installations. They supply cables of various types to the Air Ministry and their products have been used for the equipment of many R.A.F. stations, in addition to civil airports and aerodromes.

The exhibits on this stand include sample lengths of multi-core tough rubber-sheathed flexible trailing cables, with both plain and hard cord braided finish, for supplying current to portable electrical machinery, etc., and also single-conductor cables with plain and hard-cord braided finish for supplying current to electric welders.

Samples of super-tension paper-insulated cables are also shown, together with a large showcase of general types of rubber-insulated cables.

A model of an Empire flying boat will also be on view. In each of these craft considerably more than a mile of Callender cables is installed.

Chance Bros. and Co., Ltd., Lighthouse Works, Smethwick, Birmingham (Stand 5).
This firm are showing a new cone type boundary light which ensures even illumination over the entire surface of the cone, and is arranged with a special weak nipple to prevent damage to aircraft in the event of a collision.

There is also a demonstration model of the standard Chance obstruction light incorporating a small relay, which automatically illuminates a second lamp in the event of the normal lamp failing in service.

A scale working model of the three-lamp floodlight in rustless steel housing is shown, this type of floodlight being capable of an output of 1,250,000 candle power for a current consumption of only 4½ kW.

Lastly, there are numerous photographs of reflector and dioptric beacons, mobile floodlights, etc., and also a photograph of the fully automatic duplicate generating equipment recently supplied for the trans-India air route to operate in conjunction with 1½-kW reflector-type beacons, the sets being designed to operate unattended for a period of one month by time-switch control.

Chloride Electrical Storage Co., Ltd., Exide Works, Clifton Junction, near Manchester (Stand 8).
This stand carries a comprehensive selection of batteries for all purposes applicable to aerodrome equipment.

A typical small A.C. automatic "Keepalite" emergency lighting equipment of the latest type, with a self-contained rectifier and control cubicle, is wired up for demonstration purposes by the company's representatives on the stand.

Batteries for starting and lighting of aeroplanes are also exhibited as well as batteries for ground starting purposes. Exide handlamps and portable lighting projectors can be seen, together with a range of Drydex torches and batteries.

Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2 (Stand 47).
Ediswan lamps and fittings have many applications in the aeronautical world, ranging from small instrument lamps to large floodlights. A range of Rotax electrical equipment employing Ediswan lamps includes instrument lights, signalling lamps, cabin lights and navigation lamps. There are also Ediswan batteries for aerodrome and works auxiliary lighting, and for aircraft.

Lastly, there is the extensive range of Ediswan works and outdoor lighting fittings and floodlights, many for use with electric discharge lamps. They include the "Waltham" and "Wanstead" lanterns, diffusing, dispersing and concentrating reflectors, and the "Sirius" and "Argus" floodlights.

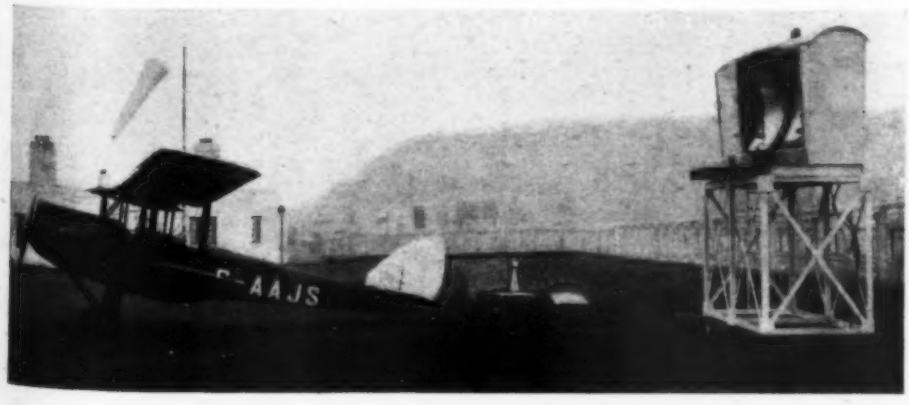
General Aircraft, Ltd., London Air Park, Feltham, Middlesex (Stand 39).
As sole licensees for the British Empire of Ahrens patents, General Aircraft are about to commence manufacture of that concern's "smoke trail" wind indicator.

It is stated that the trail can be seen easily from a very great distance; that in either steady or gusty conditions, wind direction is shown exactly where needed, i.e., on the landing ground away from obstructions; and that, sunk flush with the surface, the apparatus causes no obstruction whatever.

Crude oil is fed by gravity from a tank to a hot spot, which vaporises the oil. The source of heat is a petrol or paraffin blowpipe. Operation is exceedingly simple, the indicator needing only very occasional attention.

The General Electric Co., Ltd., Kingsway, London, W.C.2 (Stand 28)
This firm is represented by an interesting display in which "Lighting for flying" is a prominent phrase designed to draw attention to large contracts which the company has successfully completed.

A large map of the Empire routes is one of the features of the stand, and it is marked with all the aerodromes which have been equipped with G.E.C. lighting, while attention is called by means of diagrams and photographs to the route beacons supplied for the Karachi-Rangoon route and the new Australian Airways, as well as to special equipment supplied to thirty-seven aerodromes in this country, the Empire and abroad. This comprises aerodrome landing floodlights, boundary lights, construction lights, wind tees, wind velocity indicators,



One of the new Clarke Chapman floodlights at Newcastle municipal airport. This company has equipped the airport with three floodlights, neon beacon, illuminated wind tee, twenty-five boundary lights, full obstruction lighting, and remote lighting control.

A Dagenite ground-starting trolley in use by Imperial Airways. Its twelve-volt batteries are capable of 489 10-second "starts" at 100 amperes on one charge.

route beacons, and neon identification beacons.

Osira lamps for works lighting, and various types of Osram lamps for aeronautical purposes are also shown, together with G.E.C. cone-type boundary lights and obstruction lights. Landing floodlights, equipped with 1,000-watt or 3,000-watt tubular horizon-type Osram lamps with line filaments are shown pictorially.

Peto and Radford, 50, Grosvenor Gardens, London, S.W.1 (Stand 15).

The three main "Dagenite" items exhibited are for ground starting of aircraft engines. There is a compact transportable battery unit for ground-starting all types of engines operated by 12-volt starters. It is stated that the batteries fitted are capable of giving 489 consecutive 10-second "starts," at 100 amperes, on each charge, and will give as high an output as 600 amperes.

Two ground-starting batteries, Type 6.EMD15.BR., are shown coupled in series to operate at 24 volts, and can be supplied fitted in the trolley instead of the 12-volt batteries mentioned.

Lastly, there is a six-volt ground-starting battery Type 3.NSDD23-R., which has a capacity of 300 ampere-hours and has been partially sectioned to show internal construction.

In addition, a range of Dagenite accumulators for aircraft is shown.

Tilley Lamps (Stand 12).

Floodlighting: *See under Airco, Ltd., in Miscellaneous section.*

Cardiff Foundry and Engineering Co., Ltd., Hurman Street, Cardiff.

The danger of fire in the event of collision of an aeroplane with an aerodrome boundary beacon is eliminated in the case of the "Pillar of Fire" beacon. The moment an aircraft touches any one of the three supporting struts the strut breaks, the two remaining struts pulling the beacon away from the machine and at the same time breaking all electrical contact. The beacons (with their aviation orange globes) may be seen at Doncaster and Cardiff aerodromes or at stands A709 and A608 at the forthcoming British Industries Fair at Birmingham.

Clarke, Chapman and Co., Ltd., Gateshead, Co. Durham.

This firm manufactures aerodrome and airways lighting equipment, such as beacons, boundary and obstruction lights, illuminated tee-type wind-direction indicators, floodlights, ceiling projectors, wind velocity indicators, strip-type landing lights, etc.

In addition, they produce all classes of searchlights, low- and high-intensity projector lamps of the semi-automatic and fully automatic type (the latter embodying their patent light control), generating sets, switchboards, motors and control equipment, etc.

This firm has recently marketed a special stand-by generating equipment which can be arranged for automatic starting by light-sensitive devices, automatic control device, or by failure of a main supply. This set can be run for long periods unattended.

B. Dixon-Bate, Bridge Works, Chester.

Well known for their aircraft anti-fire impact switches, which would appear to have obvious application to boundary lights, this firm is now manufacturing aerodrome beacons and lighting equipment generally.

Martin-Baker Aircraft Co., Higher Denham, Bucks.

The Martin patent wind indicator is a product of this company. It measures 50ft. in length, is easily visible by day or night from 6,000ft., and is illuminated for night flying by twenty 40-watt lamps placed approximately 4ft. apart. The standard steel pylon support is about 12ft. high.

Metropolitan-Vickers Electrical Co., Ltd.

Workshop lighting and equipment: *See under Workshop Equipment.*

Troughton and Young, Ltd., 143, Knightsbridge, London, S.W.1.

The work carried out by this firm of lighting specialists in connection with airport construction comprises the complete electrical installation for lighting, heating, and power services, and lighting equipment including industrial and ornamental fittings.

Marconi's Wireless Telegraph Co., Ltd., Electra House, Victoria Embankment, London, W.C.2 (Stand 13).

In the space available at Central Hall it is not possible to show the larger types of Marconi aerodrome equipment, but the following apparatus is exhibited:

The Marconi-Adcock direction finder, type D.F.G.12 (short wave) utilises the Marconi-Adcock spaced aerial system, the special feature of which is that only the vertical members are influenced by the received waves, thereby enabling bearings of a high degree of accuracy to be obtained during periods when "night error" would otherwise be experienced.

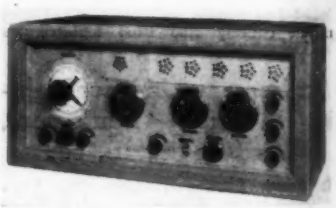
The Marconi T.W.12 telegraph and telephone transmitter is specially suitable for exacting requirements and extreme climatic conditions. The nominal rating of the transmitter is 50-60 watts to the aerial circuit for C. W. telegraph transmission, or 25-30 watts carrier with 75 per cent. I.C.W. or telephone modulation. Its wave ranges are from 200-250 and from 600-800 metres, but a modified medium wave range to cover 800-1,200 metres is also available.

A medium-wave 65-watt equipment, the G.A.D.49, is an efficient low-powered transmitter particularly suitable for local zone communication. One of these installations is in use at Gatwick.

The G.A.D.41 transmitter, a medium-wave 170-watt aircraft wireless equipment, is also suitable for local zone communication, but in cases where rather more power is required.

Standard Telephones and Cables, Ltd., New Southgate, London, N. (Stand 36).

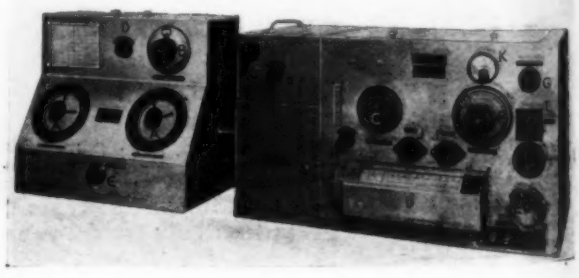
This firm is exhibiting a typical short-wave ground station, comprising a 200-watt type R 4 radio transmitter providing any four preset frequency settings between 2.73 and 7.5 megacycles, together with a type R 5 8-valve



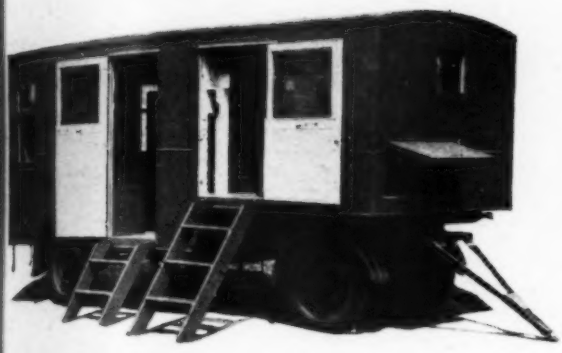
Standard-Adcock direction finder unit, type R3.

superheterodyne radio receiver, giving any service between 1.2 and 22.2 megacycles. Associated rectifier equipment for complete operation from alternating current mains is on exhibit.

There is also a Standard-Adcock direction finding system, which is especially suitable for aerodromes where a direction finding accuracy within ± 2 deg. under all conditions is essential. The receiver, situated up to 200ft. from the centre mast, provides 300-600 kc. normal reception, D.F. and 3.75-8.5 megacycles non-directional reception. A model illustrating the formation of the aerial system, together with methods of support, insulation and connection is on view, together with a type R.3 Standard-Adcock receiver.



Marconi-Adcock short-wave direction finder, type D.F.G.12.



Much in little : a mobile ½ kW aerodrome radio station in trailer, by Gambrells, Rowse and Snoaden.

Gambrells, Rowse and Snoaden, Ltd., 3, St. James's Square, London, S.W.1 (Stand 18).

A typical ground station transmitter and receiver are exhibited. The transmitter is of ½ kW rating and provides for both short- and medium-wave transmission and for telegraphy and telephony. It may be arranged for remote control and is adaptable for a variety of power supply systems. The receiver is of the superheterodyne type and has the high performance and selectivity necessary for aircraft services.

Photographs are shown of other types of equipment manufactured by the company, including mobile stations on lorries and trailers, and fixed stations of higher power.

Radio Transmission Equipment, Ltd., 225, Tottenham Court Road, London, W.1.

This company has recently been reorganised and now has a new range of equipment in production at the new factory at Mitcham, where much better facilities are available for the production of aircraft, aerodrome and direction-finding equipments, etc., than in the past.

For long-wave aerodrome communication the type M.W.09C equipment has been produced, catering for C.W. telegraphy and telephony on a wavelength range of 800 to 1,000 metres. For aircraft communication a new range is being produced, full details of which will be available very shortly. Considerable work is being carried out for aircraft operating companies and Dominion Governments.

Since the reorganisation of the company the board consists of Mr. S. R. Mullard, Mr. A. V. Harvey and Mr. N. Gunn, while Mr. A. D. Hodgson and Mr. C. E. G. Bailey are in charge of the technical departments.

Fuel, Oil and Servicing Equipment

Anglo-American Oil Co., Ltd., 36, Queen Anne's Gate, Westminster, London, S.W.1 (Stand 16).

The display by the marketers of Stanavo fuels and oils, also bulk storage installations and metering columns, shows how, at recognised aerodromes and landing grounds throughout the world, there are Stanavo filling points with supplies of fuel and oil.

It is also explained how pilots can take advantage of the Stanavo carnet system which relieves them of much of the troublesome detail usually met with when visiting foreign countries.

The Company's aviation department is at the service of all concerned with aviation, including manufacturers, municipal authorities and the like, for advice on any problems of aerodrome equipment and bulk storage, and also of fuels and oils.

National Benzole Co., Ltd., Wellington House, Buckingham Gate, London, S.W.1 (Stand 21).

The feature of this exhibit is a working model which illustrates in diagrammatic form the numerous stages in the production of benzole.

The use of benzole as an aviation fuel has grown enormously during recent years, and National Benzole Mixture pumps are now to be seen on nearly every aerodrome throughout the country.

Of interest to all aerodrome owners and operators is the subject of fuelling. The National Benzole Company's fuelling tankers are familiar at airports and flying fields throughout the country. These vehicles, mounted on six-wheeled chassis, have a capacity of 800 gallons, and enable aircraft to be refuelled without having to taxi to a fixed filling station. The mobile tanker can be driven over to any point on the aerodrome, the fuel line is swung out, and the spirit is metered out and pumped aboard.

John B. Pillin, Ltd. (Stand 25).

Oil dispensing equipment: *See under Workshop Equipment.*

Shell-Mex and B.P., Ltd., Shell-Mex House, Victoria Embankment, London, W.C.2 (Stand 35).

Shell-Mex and B.P. Limited are showing on their stand an Avery-Hardoll electric metering pump and AeroShell mobile lubricating equipment as used on aerodromes, together with specimens of lubricating oils in bottles.

Thompson Bros. (Bilston), Ltd., Bilston, Staffs (Stand 3).

Photographs on this stand illustrate the wide range of T.B. mobile refuelling units, from a light two-wheeled 50-gallon outfit to a 1,000-gallon, power-driven unit mounted on a light road chassis. Their latest production is the "T.B. Power Mobile Tender," which is in the form of two side tanks of up to 500-gallons' total capacity with an 8-h.p. engine with drive to pumping, filtering and metering equipment; the whole is mounted on three pneumatic-tyred wheels with power drive to two rear wheels.

It is, perhaps, not so widely known that Thompson Brothers also have a large output of metal aircraft components, and were among the first in the country to produce aircraft exhaust manifolds on a large scale.

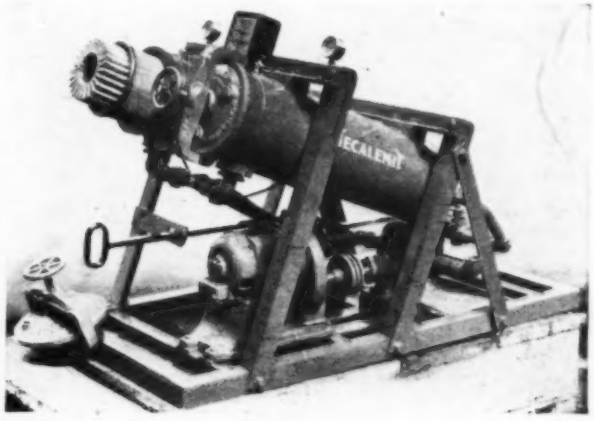
Tecalemit, Ltd., Great West Road, Brentford (Stand 33).

The Tecalemit exhibits include a demonstration group of apparatus for refuelling of aircraft, including an automatic nozzle which shuts off the flow when the tank is full, and also transfers air or petrol vapour back to the tank from which fuel is being pumped.

There is also a bulk oil filter for engine test beds. This comprises a battery of one or more filter units made up of gauze cylinders surrounding standard Tecalemit star-shaped felt elements, the whole being arranged in pressure containers mounted on a bed and provided with pump and electric motor. Very finely filtered oil can be fed to the oil intake of the engine on test, at no pressure and flow capacities up to 1,000 gallons per hour.

Other exhibits include portable apparatus for draining oil from aircraft tanks, bulk petrol filter with special de-aeration device and water filters, and a quick-fix cap for aircraft tanks.

Other Tecalemit products include: Bulk oil and water heaters for aero engines, portable refuelling pumps, engine fuel pumps, lightweight greasing equipment, etc.



Not a trench mortar but the Tecalemit oil filter for engine test beds. One filter unit is partly withdrawn.

Vacuum Oil Co., Ltd., Caxton House, Westminster, London, S.W.1 (Stand 7).

Exhibits here include different types of "packages" in which are marketed Aerc Mobiloil Red Band, Aero Mobiloil Green Band, Gargoyle Mobilgrease No. 2, as well as portable and stationary types of lubricating oil containers and cabinets.

The Mobiloil airport refuelling unit embodies a 50-gallon cylindrical tank mounted on a chassis fitted with two pneumatic-tyred wheels and having a pump, metering equipment and plainly marked dial.

Engineers are in attendance on the stand to explain the special properties of Aero Mobiloil, produced by the Clearosol process.

Graphs showing the resistance of Aero Mobiloil to oxidation are shown, and there are posters drawing attention to the Aero Mobiloil carnet scheme.

C. C. Wakefield and Co., Ltd., Wakefield House, Cheapside, London, E.C.2 (Stand 41).

Patentees and manufacturers of lubricating equipment since 1899, this well-known firm is exhibiting four items of equipment.

One is a transportable oil-dispensing trolley, carrying a twelve-gallon drum and provided with a pump. The second is a motor-driven compressor outfit which can be used for greasing, tyre inflation or paint spraying. Third is the Castrol electrically operated aircraft oil dispenser, with precision meter.

Lastly, there is the Castrol precision meter, stated to be the only British meter approved by the Board of Trade for use with lubricating oils.

Zwicky, Ltd., Slough, Bucks.

Zwicky, Ltd., specialise in aerodrome refuelling units, a large number of which have been supplied to the Royal Air Force. Certain Zwicky units, mounted on motor chassis, are made in very large capacities. Pumps and complementary equipment are also numbered among this firm's productions.

British Oxygen Company's portable tyre-inflation cylinder "topping-up" one of *Syrinx's* tyres. Incidentally, nitrogen is coming into favour for tyre inflation, and the B.O.C. claim many advantages for it.

British Oxygen Co., Ltd., Thames House, Millbank, Westminster, London, S.W.1 (31).

B.O.C. equipment for welding and tyre inflation, as used by many aerodromes and airports in this country and the Empire, form the chief exhibits on the company's stand.

Actual plant on view comprises the portable oxy-acetylene welding outfits models A and B the model O outfit for battery repairs, and various cutting outfits. The last-named, in common with the model B outfit, are shown complete with trolleys.

Brown Bros. (Aircraft), Ltd., Great Eastern Street, London, E.C.2 (Stand 26).

Here is displayed a very representative selection of equipment, including Black and Decker and Desoutter electric drills, the former on stands; Black and Decker kits of tools, tool chests and reamers; Ingersoll-Rand compressor; Mercer cylinder gauge; Black and Decker bench grinder; Epco high-lift jack; De Vilbiss spray gun; the Mariol lamp; battery testers; steel storage bins; and the Miser mobile pedestal light.

Experts of Brown Brothers' lighting engineering service are in attendance to give advice on lighting schemes for hangars and work-shops, and for aerodrome and general floodlighting.

An item of interest also marketed by this firm is an adjustable stand designed for supporting wings or tails. It has interchangeable heads of various shapes and micrometer adjustment.

V. L. Churchill and Co., Ltd., Walnut Tree Walk, Kennington, London, S.E.11 (Stand 44).

On this stand is an interesting range of general and precision equipment particularly suited to airport operators. It includes the 44U valve refacer, a precision machine which is supplied as standard equipment to the Royal Air Force.

There are also the 37F. ten-ton mechanical press for pressing on or off bearings, light straightening work, etc., and the VLC. 71B bench grinder fitted with two 7-in. wheels, a sound general-purpose machine.

Other exhibits include electric and air-operated tools for valve lapping, piston-ring expanders and groove cleaners, feeler gauges, tool boxes, etc.

Desoutter Bros., Ltd., The Hyde, Hendon, London, N.W.9 (Stand 38).

Desoutter Bros. show their wide range of pneumatic and electric portable tools. There is the drill gun range—little one-hand tools with a big capacity—a $\frac{3}{16}$-in. drill weighing only $2\frac{1}{2}$ lb., a $\frac{1}{4}$-in. capacity model weighing only $2\frac{3}{4}$ lb., and a $\frac{5}{16}$-in. capacity drill weighing only 3 lb.

Then there are corner drills for drilling in inaccessible positions, electric and pneumatic screw guns, which make the onerous task of screwdriving a speedy production job, a new high-power portable electric grinder, and bench and pedestal-type tool grinders.

Equipment and Engineering Co., Ltd., 2 and 3, Norfolk Street, London, W.C.2 (Stand 11).

Featured on this stand is the Magnaflux crack detector, which should have a number of applications in aircraft manufacture, particularly in the sphere of engines. The steel part to be tested is painted over with a special fluid and laid across the poles of a powerful magnet, and even the finest crack at once shows up clearly as a black line. A demagnetiser, for use afterwards, forms part of the equipment.

Another E. and E. speciality shown is the Simplex aircraft overhaul jack, and a third interesting item is a rotary hand broom for speedy cleaning-up of workshop floors.

Oil supplies for a D.H. 86 from a Mobiloil aerodrome unit.

Kurt Erlach, Ltd., 2, Melior Street, London Bridge, S.E.1 (Stand 20).

On this stand is a comprehensive [illegible] of "Volspray" spray-painting equipment. The most popular model, the 1A/2, will undoubtedly attract attention by reason of the performances claimed and by its compact and pleasing appearance. The whole outfit weighs only about 30 lb., operates off an A.C. or D.C. electric light point, and is fitted with a full-sized spraying pistol.

The businesslike look of the larger "Volspray" models, particularly the 11/ZW and 11/ZES, will also attract the eye of the visitor to the Exhibition. The manner in which the manufacturers keep abreast of the requirements of this fast progressing industry can be gathered from a chat with one of their technical representatives for aviation who will be in attendance, and no one should miss the superb scale models of famous types of aeroplanes made by Mr. V. M. Woodason, of Heston, and sprayed finished with the "Volspray."

Electric drill gun from the Desoutter "armoury."

Felco Hoists, Ltd., 17, Victoria Street, London, S.W.1 (Stand 24).

On this stand will be found "Felco" all-steel triple gear chain blocks and runways. These are made entirely in high quality steel, all castings having been superseded by solid steel parts; consequently, they are very robust, yet light and compact. Headroom has been reduced to a minimum and hand-wheels are all heavy-gauge steel stampings.

Secondly, there is the "Ropelock" rope pulley hoist. This, as the name implies, is of the self-sustaining type, the locking action being simple yet positive. All pulleys are fitted with grease lubricators, ensuring long life and easy working.

All hoists and chain blocks, it is stated, are tested to 50 per cent. overload working and 100 per cent. overload static, a test certificate being issued.

Grimston Electric Tools, Ltd., 138, Lever Street, London, E.C.1 (Stand 6).

Drills and grinding equipment constitute this company's display, which consists of the following items: Portable electric drills and grinding machines; flexible-shaft grinding, sanding, and polishing machines, both single and multi-speed types; "Duplex" combination electric drills and flexible-shaft grinders; "Electriska" multi-speed 1-in. bench and column drills; bench and pedestal tool grinders, with and without twist drill grinding attachments; and precision internal and external tool-post grinders.

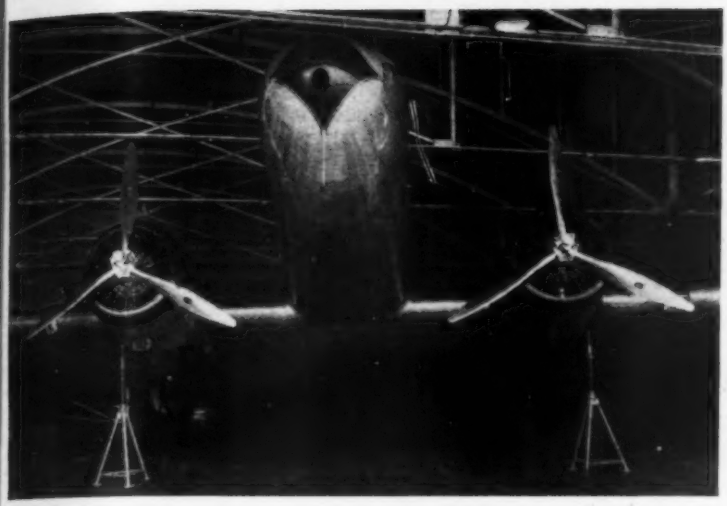
Thos. P. Headland, Ltd., Pearman Street, Westminster Bridge Road, London, S.E.1 (Stand 40).

Thos. P. Headland are exhibiting precision tools for engine reconditioning work, including the Kwikway hydro wrench for equal tightening of studs; Microbone multi-purpose bench tool; valve refacer; electric drills; dope sprayers, etc.

The Dzus cowl fastener is being shown and attention is drawn to the stocks of approved steels, bolts and nuts and other A.G.S. parts and also aerodrome, workshop and machine tools generally.

Ernest Lake, Ltd., Bishop's Stortford (Stand 17).

The aircraft workshop equipment shown on Stand 17 comprises jacking trestles, which are supplied in ten different sizes; tail trestles; fuselage stands; in-line engine stands, including a "Gipsy" model; radial engine stands; riveting tools; various jacks, etc.; and an electric vulcaniser.



Slender but strong : a heavy load does not appear to trouble jacks made by the Equipment and Engineering Co., Ltd.

Workshop Section

Laycock Engineering Co., Victoria Works, Millhouses, Sheffield, 8 (Stand 29).

On this stand will be found small portable compressors designed to deal with pneumatic tyres or paint spray guns and fitted with pressure chamber, safety valve, gauge, and drain cock; they can be plugged in to any socket.

There are also " Nor-Easter " air compressors (automatic), particularly useful where a reasonable air supply is required at 150 lb. pressure and a low pressure-building cost is essential. The patented mechanical bleeder valve prevents motor trouble and a special check valve isolates all tank pressure. Lastly there are " Niagara " washing plants, for general power washing; and connecting-rod aligners.

London and Midland Steel Scaffolding Co., Ltd. (Stand 46).

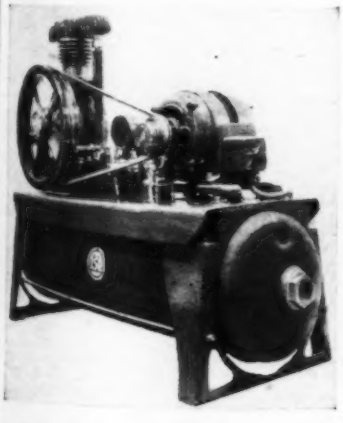
Erecting-shop stagings, storage racks, etc. *See under Buildings.*

Newton Bros., 1, Pontefract Road, Cudworth, Yorks (Stand 34).

On this stand will be found the Newton universal boring bar, an equipment for boring main bearings in situ. Heavy cast-iron jigs support a line boring bar ground to fine limits. Bearings are bored, faced and radius-turned by cutters set by micrometer.

There are also the Newton universal con-rod boring jig, which will bore, face and radius-turn all sizes of con-rods, and the Newton " Masterpiece " con-rod aligner, which will check every feature of con-rod finish. It includes new type expanding mandrels, bending and twisting tools and two-dial indicators.

Other items shown are a self-calibrating vee micrometer, universal piston vice, and remetalling jigs.



The " Nor-Easter " 150 lb. air compressor, made by the Laycock Engineering Co., Ltd.

John B. Pillin, Ltd., Church Hill, Beckenham, Kent (Stand 25).

The exhibits on this stand comprise a portable 2½ to 3 cu. ft. air compressor operating from ordinary wall plug; type 30VS spray gun for use for penetrating oil or paraffin, designed to work in any position with minimum quantity of fluid, and with handle detachable for use as blow gun; type BG blow gun; transportable oil-dispensing trolley with V5 precision meter; air and electrically operated engine-oil delivery pumps working direct from barrel; oil-dispensing hose towers; and precision bulk-delivery meters in various sizes.

The Aerograph Co., Ltd., Lower Sydenham, London, S.E. 26.

One of the most valuable pieces of equipment that an aerodrome can possess is a portable spray-painting plant, not only for refinishing and doping aeroplanes but also for the maintenance painting of buildings and sheds. Such a plant enables one operator to do as much work as four or five brush-hands and produces a beautiful surface entirely free from brush marks and other imperfections.

Compact design, simplicity and extreme mobility are features of the Aerograph P.W.1 spray-painting plant, described in the accompanying paragraph.

The Aerograph Type P.W.1 portable spray-painting plant, one of the many Aerograph types, is highly suitable for this work, and it is provided with a twin-cylinder air compressor having a displacement of 7 cu. ft./min., thus enabling a full-size spray gun to be used. The compressor is provided with an automatic unloader and it is driven by a securely fenced vee belt from a 1-h.p. electric motor. The strongly welded air receiver is mounted horizontally under the pressed steel base of the plant and an air transformer is provided, permitting the operator easily to alter the air pressure for different materials and effects.

The Type P.W.1 plant is supplied at a modest price complete with a standard Aerograph spray gun and a 25-ft. length of air hose.

Aerostyle, Ltd., 176, St. John Street, London, E.C.1.

Aerostyle, Ltd., have closely studied the requirements of paint and dope-spraying work, and specialise in portable plant, which will be found fully described and illustrated in their catalogue.

B.E.N. Patents, Ltd., Gorst Road, Park Royal, London, N.W.10.

Makers of a wide range of paint- and dope-spraying equipment, this firm list a number of items applicable to maintenance-shop work, among which may be mentioned the portable " Pneu-Spray machine," available with either electric motor or petrol-engine drive.

There is also a spray gun specially designed for handling dopes and synthetic finishes as well as paints, varnishes, etc., with maximum speed of coverage. A round or fan spray can be obtained by a simple adjustment of the spray head.

Brook Motors, Ltd., Empress Works, Huddersfield.

Power may be said to be the keystone of maintenance-shop operation, and reliable, economical electric motors a *sine qua non*.

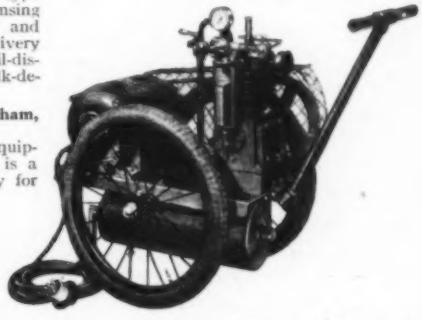
Brook " Empress " motors, of the capacitator-start, induction-run, single-phase type, well merit investigation. Used on supplies of under 250 volts, they can be started direct by double-pole switch and electrically reversed. In a motor of this type there are no brushes or commutator to wear out or—an important point this, in airport operation—to cause interference with radio.

Docker Bros., Rotton Park Street, Ladywood, Birmingham, 10.

In addition to their wide range of dopes and synthetic finishes for aircraft, Docker Bros. supply considerable quantities of paint for aerodrome buildings, known as " Hermator "; this is a leadless finish and is supplied in all the usual forms—primings, undercoatings, matt, glossy, etc.

Gledhill-Brook Time Recorders, Ltd., Empire Works, Huddersfield.

Promoting efficiency in workshop organisation by means of modern timekeeping, wage and cost accounting systems has been the special study of the Gledhill-Brook Company, makers of mechanical and electrical time recorders. The latest systems are fully explained in their catalogue, the contents of which will surprise anyone not fully in touch with the remarkably thorough methods now in use.



Hydran Products, Ltd., Staines, Middlesex.

Safe and economical methods of heating hangars and workshops often present a problem. One solution is suggested by the " Hydra " oil burner for heating boilers. It runs on waste engine or gear oil, or the heaviest fuel oils, and, with the aid of an electric supply connection, will start up instantly from cold.

Incandescent Heat Co., Ltd., Cornwall Road, Smethwick, Birmingham.

Specialists in all types of industrial furnaces and equipment, this firm includes in its wide range a number of smaller heat-treatment furnaces suitable for installation in the larger aerodrome repair and maintenance shops.

C. H. Johnson and Sons, Ltd., Smedley Road, Manchester, 8.

Manufacturers of the "Frama" welding plants, this firm has developed a system by which the relative pressures of acetylene and oxygen are balanced automatically and independently of the welder's skill, thus ensuring an optimum blowpipe flame throughout the job, with consequent absence of oxydisation, carbonisation and back-firing.

They have also evolved "central" plants, two differing types utilising high- and low-pressure acetylene respectively, wherein the cylinders or generators are at a central point, thus economising space, and supplies are piped to the blowlamps. Automatic regulation is again a feature.

Lacy-Hulbert and Co., Ltd., Boreas Works, Beddington, Croydon.

One of the specialities of this firm is an automatically controlled, direct-driven air compressor plant for centralised compressed air supply for aerodromes, aircraft workshops, etc.

Similar plants are supplied for the operation of pneumatic tools, spraying paint, tyre inflation, and many other uses. These are made in sizes varying from 2½ cu. ft. to 400 cu. ft. of free air per minute.

Metropolitan-Vickers Electrical Co., Ltd., Manchester and Sheffield.

Products of Metropolitan-Vickers include electric motors, generators and control gear; electric welding equipment; "Cosmos" lamps for factory and office lighting; electric discharge lamps for lighting large areas; and electrical measuring instruments of every kind. Another Metrovick product, type M-V "C" (patent) alloy, is already widely used in the aircraft industry. This high-grade aluminium-silicon alloy is stated to be exceptionally pure, lighter than aluminium, and in strength and ductility exceeds the requirements of the Admiralty, Air Ministry, and B.S.I. specifications.

Ransomes, Sims and Jefferies.

Blackburn tail trolley: *See under Aerodrome Surface Preparation.*

Rubery, Owen and Co.. Ltd., Darlaston, Staffs.

Two aspects of the wide scope of this firm are of particular application to airport work. The steel equipment department can supply workshop storage equipment, and the structural department has supplied the steelwork for some of the largest buildings in the country.

Apart from these activities, the firm has been known since the inception of the aircraft industry for general components, turnbuckles, eyebolts, bolts and nuts, shackles, fork-ends, pins and washers, etc., and all manner of A.G.S. parts.

Fire Fighting and Crash Equipment

Bell's Asbestos and Engineering Supply Co., Slough, Bucks (37).

This exhibit directs attention to the adoption of fireproof asbestos suits. Of two types which are available, one, which has already been adopted, is a heavy suit for rescue and salvage work, in which it is possible to withstand a heat of 1,700 degs. F., and the other a lighter form of clothing resembling overalls, which can be used by pilots.

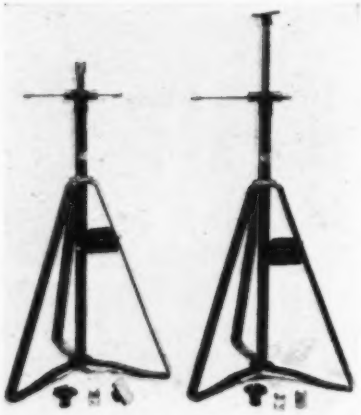
Other important asbestos products are shields with which fire-fighters can protect themselves while approaching the seat of the fire, and gloves which aerodrome regulations now make a compulsory equipment.

Safety curtains of woven asbestos, as well as movable asbestos screens, which can immediately isolate any outbreak of fire, are another interesting product on exhibition, together with curtains for everyday use in coloured asbestos fabric of attractive design.

The General Fire Appliance Co., Ltd., 11, Queen Victoria Street, London, E.C.4 (Stand 32).

This firm is showing a complete range of fire-fighting appliances for the protection of aerodromes. Of particular interest is the 30-gallon "Bromylene" extinguisher, which gives off 240 gallons of foam impregnated with gas. It is a most efficient appliance for dealing with crash fires and is used throughout the Royal Air Force for this purpose.

The two-gallon "Fire Froth" extinguisher is an auxiliary appliance to be used on small fires in aircraft workshops. Other equipment includes the quart size methyl-bromide extinguisher as used in R.A.F. aircraft; flameproof helmet and gauntlets; the Reid grab hook; bolt croppers; and lightweight breathing apparatus for combating fumes. All these appliances are approved by the Air Ministry.



Adjustable wing or tail jacks by Brown Bros. (Aircraft), Ltd.

National Fire Protection Co., Ltd., Petersham Road, Richmond, Surrey.

The National Fire Protection Co., Ltd., has made a special point of examining the needs of airports and clubs in regard to fire protection equipment. A careful scrutiny has been made of Air Ministry Pamphlet No. 55, and the firm now issues a price list of all specified equipment, both crash and medical.

Among this equipment special notice should be taken of the "National" methyl-bromide trailer, and the "Richmond" 34-gallon foam machines on wheels. The company states that it is the pioneer manufacturer of methyl-bromide equipment, of which so much is employed by the Royal Air Force for the protection of both aircraft and aerodromes.

The Pyrene Co., Ltd., Great West Road, Brentford, Middlesex.

The Pyrene Company manufacture all kinds of appliances for dealing with aeroplane and aerodrome fires.

The Pyrene extinguisher is largely used on air liners, while the Pyrene pressure-type extinguishers are supplied charged with Pyrene liquid or methyl bromide. In the latter case they are approved by the Air Ministry for aeroplane protection.

"Phomene" foam fire appliances are made in a wide range of hand extinguishers, engines and generators, while the Pyrene foam-making branchpipe is a new and highly effective foam unit.

Pyrene appliances also include CO_2 extinguishers and installations, general fire appliances and complete crash equipment.

FLIGHT

STAND 48

A selection of enlargements of *Flight's* unique aerial photographs will be a prominent feature of this stand—which, incidentally, is conveniently situated to the right of the main entrance and makes a useful business rendezvous.

Miscellaneous

Airco, Ltd., 3, St. James's Square, London, S.W.1 (Stand 12).

This Company claims a unique position in the aircraft industry, as pioneers of aerodrome equipment factoring, and sole representatives for a number of well-known technical products.

Their activities range from the supply of new and secondhand aircraft and spares to a full range of aerodrome equipment. The airport owner will find much to interest him on this stand. Lighting equipment is well represented, for Airco, Ltd., are sole agents for the British Isles for Clarke, Chapman and Co., Ltd., and also for the Tilley Lamp Co.

Another very interesting section is the book department, from which any publication on aviation may be obtained. The Interavia ABC, too, is on show. Pilot's equipment is yet another Airco speciality, and a special catalogue has been prepared.

On Stand No. 12 may be seen the latest Tilley floodlights. This comprises three projectors, turntables and trolley, making the complete unit mobile. A unique feature of this unit is that it is oil-burning, costing practically nothing to run. Also shown are a single floodlight projector and a hand lamp for repair work. Other items, too numerous to describe in detail, include fire-fighting equipment. Hurlinite glass substitute, heating equipment for buildings, airport weighing machines, and "Lobbo" aircraft and aerodrome cleaner.

Kelvin, Bottomley and Baird, Ltd., Marlow House, Lloyds Avenue, London, E.C.3.

Primarily makers of aircraft and testing instruments, this firm also markets one accessory which is found at aerodromes the world over—the Aldis signalling lamp. It can be used to signal over distances up to ten miles by day and twenty by night.

Short and Mason, Ltd., Aneroid Works, Walthamstow, London, E.17 (Stand 10).

The imposing array of instruments on this stand includes the S. and M. micro-barograph, as used by the Meteorological Office, giving a visible record increased two to three times that of the ordinary type barograph; S. and M. large model M.O. micro-barograph, a considerably larger edition of the above and now used by the Meteorological Office as a standard model; standard Fortin mercurial barometer; M.O. pattern station mercurial barometer; thermograph; hygrographs; Stevensons screen; recording rain gauge, and other types; electrical M.O. pattern anemometer; Robinson cup anemometer, and other types; electrical wind direction indicator; surveying-type aneroid barometer; various laboratory test apparatus; Fulscope temperature controller (for controlling and recording the admission of a heating or cooling medium to any industrial heating processing apparatus); Fulscope humidity recording controller (for controlling humidity within extremely close tolerances); Fulscope reset controller (for maintaining a fixed differential between one controlled and one uncontrolled medium); and recording temperature and dial thermometers.

Smith's Aircraft Instruments, Cricklewood, London, N.W.2.

Manufacturers of an almost endless range of aircraft instruments, Smith's also handle equipment of interest to airport operators, including Standard radio (see page 74) and Essex fire extinguishers.

THE ROYAL AIR FORCE

AIR AID-DE-CAMP TO THE KING

The Air Ministry announces the appointment of Group Captain Keith Rodney Park, M.C., D.F.C., as Air Aide-de-Camp to His Majesty the King in succession to Air Commodore Robert Leckie, D.S.O., D.S.C., D.F.C., who relinquished the appointment on promotion to his present rank on January 1.

AIR FORCE LIST

The January issue of the *Air Force List* has now been published. It can be purchased (price 3s.) from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh; 2, York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square, Belfast; or through any bookseller.

MOVE OF A SQUADRON

No. 103 (Bomber) Squadron will move to Usworth by March 4, 1937, on which date the unit will be transferred within the Bomber Command to No. 1 (Bomber) Group.

NEW SQUADRONS FORMED

No. 223 (Bomber) Squadron formed at Nairobi, Kenya, on December 15, and was placed in the Middle East Command with effect from that date. The squadron consists at present of a headquarters and one flight and is self-accounting for pay and stores.

No. 108 (Bomber) Squadron formed at Upper Heyford on January 4. The unit is being equipped with light bomber type of aircraft and is placed in the Bomber Command, No. 1 (Bomber) Group, until it moves to Farnborough on February 16, when it will be transferred to No. 2 (Bomber) Group.

ROYAL AIR FORCE GAZETTE

London Gazette, January 12, 1937

General Duties Branch

Group Capt. K. R. Park, M.C., D.F.C., is appointed Air Aide-de-Camp to the King (January 1), in the vacancy created by the promotion of Air Comdre. R. Leckie, D.S.O., D.S.C., D.F.C., to air rank. Flt. Lt. A. W. Sweeney is granted a permanent commission in that rank (January 11).

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—R. N. J. White, I. S. Williams (December 16, 1936); M. H. de L. Everest (January 3).

Sqn. Ldr. W. M. Yool is granted the acting rank of Wing Cdr. (unpaid) with effect from December 21, 1936; Capt. N. R. M. Skene, R.M., Flt. Lt., R.A.F., ceases to be attached to the Royal Air Force on return to duty with the Royal Marines (January 1); Sqn. Ldr. H. Cockerell, O.B.E., is placed on the retired list (January 8); Flt. Lt. A. W. M. Finny is transferred to the Reserve Class A (December 19, 1936); Flt. Lt. M. C. Lassetter resigns his short service commission (January 1); Flt. Lt. W. R. Cox resigns his short service commission (January 6); Lt. Cdr. J. C. Richards, R.N., Flt. Lt., R.A.F., relinquishes his temporary commission on return to Naval duty (November 23, 1936).

Equipment Branch

The following are granted permanent commissions as Pilot Officers on probation with effect from and with seniority of January 1:—R. R. Goodbody, F. G. C. Gilbert, A. MacR. Aberdein, F. P. Dawson, R. P. Norman, R. F. B. Guy, A. J. Goatly, P. N. Sowman, W. R. Ford, R. H. E. Dowse-Brenan, R. V. B. Franklyn, E. G. Farthing, B. R. Siminson, D. J. Barber, C. T. Wardman, J. P. Cody.

Pilot Officer on probation P. H. Stibbs is confirmed in rank and promoted to the rank of Flying Officer (January 6); Flying Officer on probation F. C. Crowdy is transferred to Commissioned Photography Officer with effect from December 25, 1936, and with seniority of January 6, 1936.

Medical Branch

The following Flight Lieutenants are granted permanent commissions in that rank (January 8):—H. Bannerman, M.B., B.S., I. Mackay, M.B., Ch.B., D.P.H.

Flt. Lt. H. S. Barber, M.B., B.Ch., is transferred to the Reserve Class D (January 8); Flt. Lt. M. T. O'Reilly, M.B., B.Ch., resigns his permanent commission (January 4).

Chaplains' Branch

The Rev. A. C. Gates is granted a short service commission with the relative rank of Squadron Leader with effect from and with seniority of January 1; the Rev. P. J. O'Connell is granted a short service commission with the relative rank of Squadron Leader, with effect from and seniority of December 28, 1936.

ROYAL AIR FORCE RESERVE

Reserve of Air Force Officers

General Duties Branch

P. Dunphy is granted a commission as Pilot Officer in Class AA (January 12); F/O. C. B. Dove is granted the hon. rank of Flight Lieutenant (December 10, 1936); F/O. C. P. Allen is transferred from Class AA (i) to Class C (November 13, 1936); Flt. Lt. G. R. Hicks, D.R.C., is transferred from Class C to Class A (December 18, 1936); F/O. N. Foster-Packer relinquishes his commission on appointment to a commission in the South African Air Force Special Reserve of Flying Officers (October 27, 1936); Flt. Lt. C. A. Elliott resigns his commission (December 14, 1936).

AUXILIARY AIR FORCE

General Duties Branch

No. 600 (CITY OF LONDON) (FIGHTER) SQUADRON.—P/O. D. de B. Clark is promoted to the rank of Flying Officer (November 27, 1936).

No. 602 (CITY OF GLASGOW) (BOMBER) SQUADRON.—D. M. Jack is granted a commission as Pilot Officer (November 8, 1936).

No. 603 (CITY OF EDINBURGH) (BOMBER) SQUADRON.—P/O. J. L. G. Cunningham is promoted to the rank of Flying Officer (November 6, 1936).

No. 605 (COUNTY OF WARWICK) (BOMBER) SQUADRON.—P. G. Leeson is granted a commission as Pilot Officer (December 5, 1936).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Wing Commander.—C. F. Horsley, M.C., to Headquarters, R.A.F., India, New Delhi; for duty as Senior Personnel Staff Officer, vice Wing Cdr. A. S. Maskell, 3.12.36.

Squadron Leader.—R. W. G. Lywood, to No. 11 Flying Training School, Wittering; for Administrative duties, 28.12.36.

Flight Lieutenants.—A. M. Rodgers, to Special Duty List; for duty with Indian Air Force, 25.11.36. A. F. McKenna, to No. 2 (Indian Wing) Station, Risalpur, India, 2.12.36. J. W. C. More, to No. 800 (Fleet Fighter) Squadron, 31.12.36. S. H. C. Gray, to No. 1 Flying Training School, Leuchars, 30.12.36. H. F. Luck, to R.A.F. Station, Cardington, 1.1.37. J. F. X. McKenna, to Aeroplane and Armament Experimental Establishment, Martlesham Heath, 3.1.37. W. G. Campbell, C. M. H. Outram, to No. 42 (Torpedo Bomber) Squadron, Donibristle, 14.12.36. B. M. Cary, to No. 204 (Flying Boat) Squadron, Mount Batten, 23.12.36.

Pilot Officers.—R. H. Paterson, to R.A.F. Station, Cardington, 1.1.37. A. Hibberd, J. S. Tupholme, to No. 42 (Torpedo Bomber) Squadron, Donibristle, 14.12.36. E. L. Hyde, E. A. Whiteley, to No. 204 (Flying Boat) Squadron, Mount Batten, 23.12.36. E. J. Brooks, H. D. Newman, J. M. H. Sinclair, to No. 210 (Flying Boat) Squadron, Pembroke, 23.12.36.

Acting Pilot Officers.—D. J. How, I. P. Grant, to No. 9 (Bomber) Squadron, Scampton, 25.12.36. W. B. G. Bonsey, G. R. G. Henderson, to No. 10 (Bomber) Squadron, Boscombe Down, 25.12.36. D. J. Gudgeon, B. J. Rogers, to No. 12 (Bomber) Squadron, Andover, 25.12.36. R. M. Blennerhassett, D. O. Butler, to No. 15 (Bomber) Squadron, Abingdon, 25.12.36. W. P. Cambridge, to No. 29 (Fighter) Squadron, North Weald, 25.12.36. H. L. McL. Bulloch, R. H. Sleigh, to No. 38 (Bomber) Squadron, Mildenhall, 25.12.36. J. N. de M. Tyrrell, to No. 49 (Bomber) Squadron, Worthy Down, 25.12.36. N. L. Ievers, to No. 56 (Fighter) Squadron, North Weald, 25.12.36. J. W. E. Davies, to No. 74 (Fighter) Squadron, Hornchurch, 25.12.36. A. P. G. Hyde, to No. 78 (Bomber) Squadron, Boscombe Down, 25.12.36. E. R. D. Vaughan, to No. 98 (Bomber) Squadron, Hucknall, 25.12.36. G. E. Newton, to No. 104 (Bomber) Squadron, Hucknall, 25.12.36. M. F. Hendry, to No. 139 (Bomber) Squadron, Wyton, 25.12.36. H. J. A. Thewles, to No. 220 (General Reconnaissance) Squadron, Bircham Newton, 25.12.36. W. H. Cheetham, P. D. F. Mitchell, J. R. Pennington-Legh, to R.A.F. Station, Gosport, 25.12.36. R. C. O. Lovelock, F. Phillips, A. G. Wincott, to School of Air Navigation, Manston, 25.12.36. G. K. Peacock, to No. 7 (Bomber) Squadron, Finningley, 25.12.36. R. D. E. Pitcairn, D. L. Rayment, to No. 12 (Bomber) Squadron, Andover, 25.12.36. C. D. Fox, J. F. Newman, to No. 38 (Bomber) Squadron, Mildenhall, 25.12.36. I. B. Gleed, P. G. Jameson, L. G. Schwab, M. O. Scott, G. S. Woodwark, to No. 46 (Fighter) Squadron, Kenley, 25.12.36. L. M. Beavis, K. M. Gillies, to No. 66 (Fighter) Squadron, Duxford, 25.12.36. H. F. Plank, J. F. Sutton, to No. 98 (Bomber) Squadron, Hucknall, 25.12.36. W. R. Gardiner, to No. 99 (Bomber) Squadron, Mildenhall, 25.12.36. T. A. Bunting, to No. 102 (Bomber) Squadron, Finningley, 25.12.36. N. J. Starr, to No. 104 (Bomber) Squadron, Hucknall, 25.12.36. P. Corbishley, B. O. Huxtable, G. C. O. Key, W. M. Lupton, to No. 114 (Bomber) Squadron, Wyton, 25.12.36. D. I. Jobson, T. W. Lamb, A. N. Macfarlane, R. A. G. Morgan, R. N. Wall, to No. 139 (Bomber) Squadron, Wyton, 25.12.36. G. V. Aylott, to No. 215 (Bomber) Squadron, Driffield, 25.12.36. S. F. Coutts-Wood, C. A. R. Crews, E. A. Hunt, to No. 218 (Bomber) Squadron, Upper Heyford, 25.12.36.

Equipment Branch

Pilot Officer.—N. V. Lindermere, to R.A.F. Station, Mildenhall, 1.1.37.

Accountant Branch

Wing Commander.—P. J. Wiseman, to Directorate of Personal Service, Air Ministry, 4.1.37.

Squadron Leader.—E. J. Grout, to Headquarters, Coastal Command, Lee-on-the-Solent; for Accountant duties, 1.12.36.

COMMERCIAL AIRCRAFT ENGINES

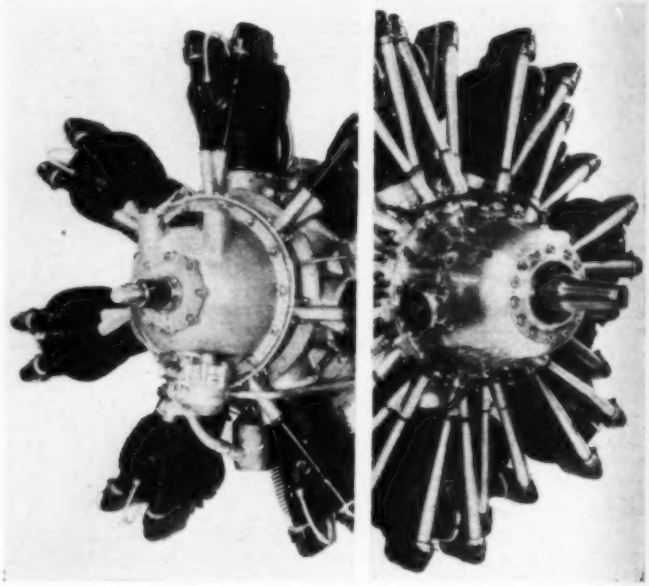
A Review of the Many Types of Widely Differing Horse-power, now Available for Passenger Aircraft

THE greatly increased demand for civil and military aeroplane engines has given scope for a variety of engines the horse-power figures of which now range from as low as 80 up to 1,000 and over.

Although the specifications of most aircraft types provide only for one make of engine, in actual fact, half a dozen or more makes could be used as alternatives if desired. Keen competition is welcome for its power to stimulate an industry and assure first-class products of high efficiency and great reliability—though it is not suggested that the British aero engine manufacturers need any stimulant.

Several engines available to commercial operators are now rated on 87-octane fuel, but as yet none on 100-octane. This is to be expected, but it is possible in the future that fuel of 100-octane value will be used.

During the last year considerable progress has been made with the latter. In long-range airline services the commercial advantage would probably be most definite. The high compression ratio needed for low fuel consumption has, however, brought with it problems and troubles besides those encountered due to corrosion of valves, sparking plugs, etc. Also the actual cost of 100-octane fuel and the difficulty of obtaining it in quantity makes it impracticable for would-be operators at the present time. It has been estimated that for an engine with cylinders of about 1½ to 2 litres capacity, a compression ratio of 8 to 1, and moderate boost, a fuel consumption of 0.38lb./b.h.p./hr. is now possible



A pictorial comparison of Armstrong Siddeley Tiger IX and Cheetah IX. Both these engines are available with V.P. Airscrews.

ALVIS

Alvis, Ltd., Coventry.

IMPORTANT announcements are expected from Coventry within the next few weeks with regard to the three Alvis types which are now in process of production.

Alcides, Pelides and Maeonides Major by name, these engines are known more briefly as the "18 L," "14 N," and "14 M."

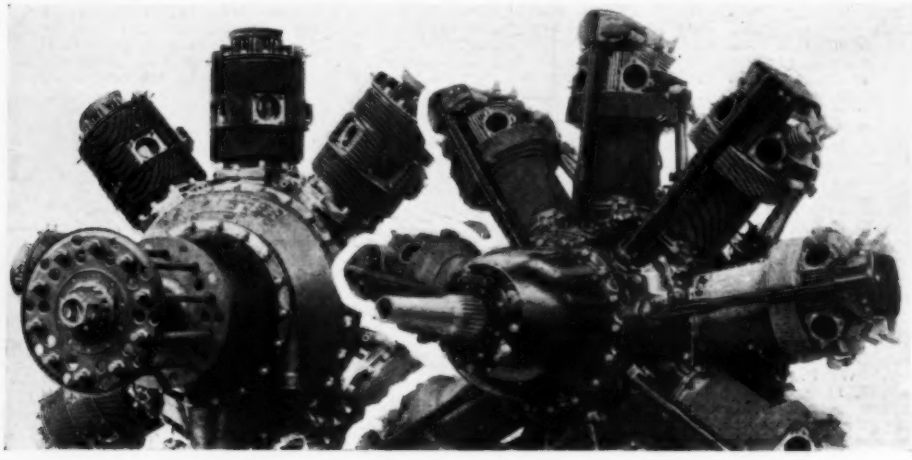
The Maeonides Major (14 M) is an exceptionally compact, fully supercharged, two-row radial giving 650 h.p. normal at 3,000 r.p.m. and 13,000 ft. Only 38 inches in diameter, this engine weighs 830 lb.

The Alcides (18 L) and Pelides (14 N) are offered in moderately supercharged form giving 1,300 and 1,000 h.p. at 5,000 ft. respectively, and in "Major" form fully supercharged to give 1,225 h.p. at 13,000 ft. and 1,000 h.p. at 12,000 ft. respectively. Fuel of 87 octane value is specified in each case.

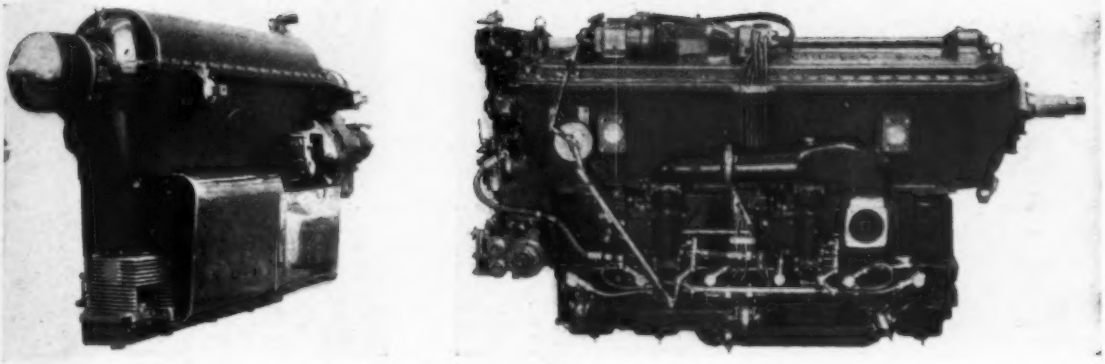
ARMSTRONG SIDDELEY

Armstrong Siddeley Motors, Ltd., Parkside, Coventry.

AMONG the medium-sized units suitable for use on feeder lines are the Lynx IVc and Cheetah V and IX. These two types in their latest form are the outcome of many years' development. The seven-cylinder radial Lynx IVc is of 45.6 inches diameter and gives 225 h.p. for take-off at 1,900 r.p.m., and 240 h.p. maximum at 2,090 r.p.m. Installed in the Airspeed Courier (Type A.S.5) the economic cruising output, which gives a speed of 132 m.p.h.,



The Bristol Aquila and Pegasus engines are both noted for clean lines among their type. The Aquila has, of course, sleeve-valves and the characteristic immunity from projections is well illustrated.



(Left) "Streamlined without cowling" describes this latest Cirrus Major Mark II. (Right) There is very little difference in the external appearance of the D.H. Gipsy Six Series I and II. The more neatly placed accessories are shown in this photo of the Series II.

is 184 h.p. at 1,900 r.p.m., and at a fuel consumption of about 12 gall./hr. The climb to 10,000 ft. takes 8½ min. as compared with 6¼ min. for the Cheetah V (also unsupercharged, and without reduction gear), which is an alternative power unit.

The Cheetah V has seven cylinders and is 2.1 inches larger in diameter; it gives 296 h.p. for take-off and 326 h.p. maximum at 2,400 r.p.m. The weights of the Lynx IVc and the Cheetah V are 515 and 596 lb. respectively.

With direct drive and a rated altitude of 6,000ft., the moderately supercharged Cheetax IX is built in accordance with the latest engine practice. A De Havilland variable-pitch airscrew is available and 87-octane fuel is specified. The rated output at 6,000ft. is 310 h.p. at 2,100 r.p.m., and 340 h.p. may be obtained for take-off. The maximum horse power is 350 at 7,300 feet and 2,425 r.p.m. A fuel consumption of about 14 gall./hr. is recorded for economical cruising.

One of the large engines for commercial use, the 14-cylinder two-row Tiger IX, is of a type which has been ordered very extensively for military use. The new Imperial Airways four-engined A.W.27 monoplanes are powered by this unit. A D.H. variable-pitch airscrew is standard equipment, and at a rated altitude of 6,250 feet, 805 h.p. is given for normal use, while at 7,200 feet this figure represents maximum output. For take-off 880 h.p. is given. The diameter of the engine is 50.8 inches and the weight with 0.594:1 reduction gear 1,220 lb.; fuel of 87-octane value is used, the consumption at cruising speed being about 35 gall./hr.

BRISTOL

The Bristol Aeroplane Company, Filton, Bristol.

MOST important from the civil point of view are the Pegasus Xc, the Perseus II, IIIm and VIII, and Aquila with civil rating. One of the best known engines in the world, the Pegasus; the Xc is a medium supercharged nine-cylinder radial, designed for running on 87-octane fuel. The rated altitude is 3,500 ft. and a 0.5:1 reduction gear is fitted. The take-off output is 920 h.p., and the normal output 815 h.p. at 2,250 r.p.m. With a diameter of 55.3 inches, the engine weighs 1,015 lb., so that a normal power to weight ratio of 1.37 lb. per h.p. is shown.

Perseus and Aquila sleeve-valve engines are now almost as well known as the Pegasus. Full figures are not yet available, but the Aquila is rated at 500 h.p. at 2,600 r.p.m. at sea level, and the Perseus IIIm at 580-605 h.p. at 4,500ft. and 2,200 r.p.m. The slightly earlier so-called civil-rated Perseus II, which weighs 1,026 lb., gave 649-665 h.p. at sea level at 2,200 r.p.m. with 740-770 h.p. maximum. The military Perseus VIII gives a maximum output of 810 h.p.

CIRRUS-HERMES

Cirrus-Hermes Engineering Co., Ltd., Brough, Yorks.

THE Cirrus Minor, the smaller of the two models, is a neat and simple four-cylinder, inverted, air-cooled unit giving 82 h.p. at 2,300 r.p.m. and 90 h.p. at 2,600 r.p.m.; the complete weight is 195 lb. The consumption at cruising revs. is 3½-4 gall./hr. of petrol and ¼-1½ pts. per hour of oil.

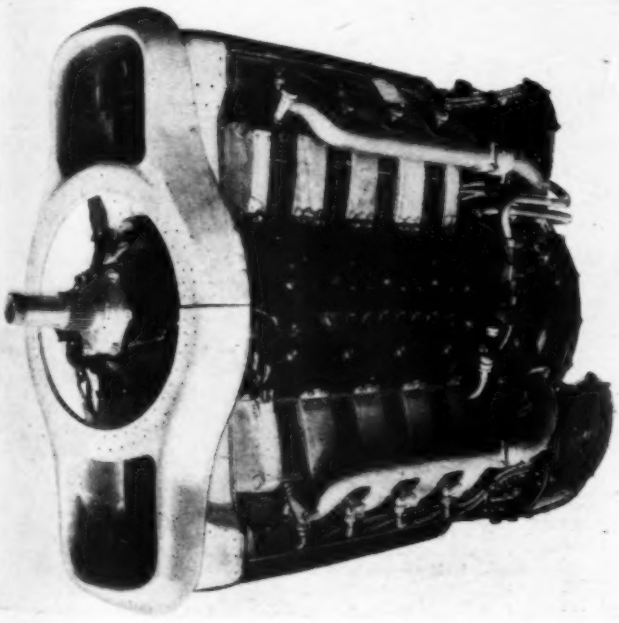
Very clean lines characterise the Cirrus Major Mark II, which is rated at 135 h.p. at 2,200 r.p.m. and 148 h.p. at 2,450 r.p.m.

DE HAVILLAND

The De Havilland Aircraft Co., Hatfield Aerodrome.

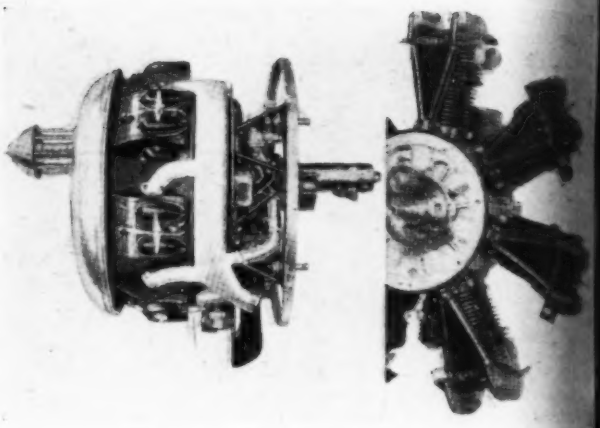
AS familiar to the commercial operator as to the private owner, Gipsy engines have an enviable record. The 120-130 h.p. inverted, air-cooled four-in-line Major must have drawn hundreds of fledgelings skyward on their first solos, and Gipsy Major and Six engines have figured in more than fifty record and long-distance flights. As regards the Major, 750 hours between overhauls may be run. The fuel and oil consumption are 6.25 to 6.75 gallons per hour and 1.25 pints per hour respectively at normal—2,100 r.p.m.—engine speed, while maximum fuel consumption at 2,350 r.p.m. is only 9¾ gallons. The engine weighs 300 lb. ± 5. A Series II version of the Gipsy Major with v.p. airscrew, and running on 77-octane fuel, is on the way.

In *Flight* of January 7, 1937, the new Gipsy



The installation of this 340 h.p. Rapier V, shown with cowling frame, should present no difficulty.

Two elevations of the Pobjoy Niagara III show many details of this tiny seven-cylinder radial.



Six Series II was illustrated and described in detail. The engine is rated on 77-octane fuel, but is suitable for leaded fuels of that knock rating when D-T.D. 224 is not available.

The type "1,000" De Havilland V.P. airscrew with 9 deg. pitch range can be fitted; this weighs 77½ lb. complete with spinner.

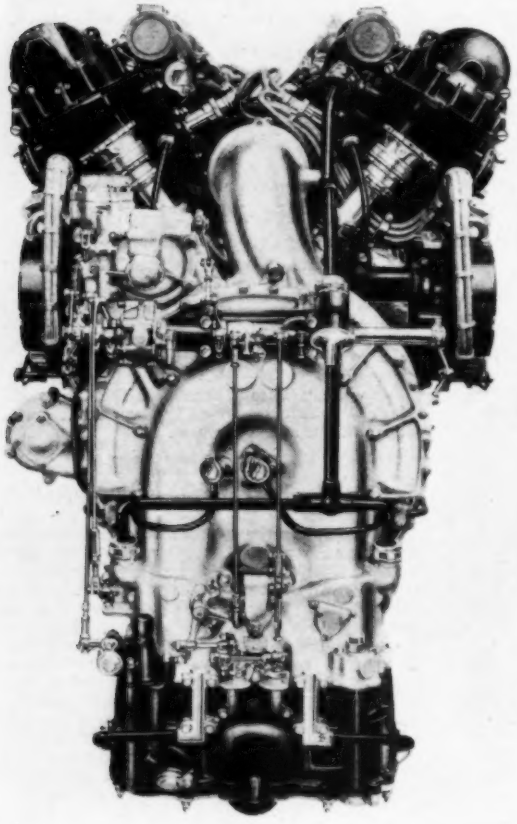
The Series II engine differs in power from the Series I in having a higher continuous output available and in giving greater take-off r.p.m. and power. The Series I is of 185 h.p. normal and 205 h.p. maximum rating, and the Series II gives 205 h.p. maximum and, with v.p. airscrew, up to that figure for normal cruising.

It is hoped that figures for the Gipsy Twelve air-cooled, inverted vee-type engine will be available shortly. As reported recently in *Flight*, a Gipsy Six II, regarded for the experiment as one half of a Twelve, ran for twenty hours at 4 lb. boost and 2,600 r.p.m., giving 309 h.p., while at higher engine speed and the same boost, 325 h.p. was obtained.

NAPIER

D. Napier and Sons, Ltd., Acton, London, W.

ONE of the most interesting engine designs in the world will shortly come more into prominence in commercial aviation. The Rapier V or VI, sixteen-cylinder, air-cooled, H-type engines have in the past been installed in various types, including the Airspeed Courier and Blackburn H.S.T.10, besides military aircraft. Most interesting will be the installation of four Rapier Vs with controlled cooling in the upper component of the new Short Mayo composite aircraft.



A rear view of the fully supercharged Rolls-Royce Kestrel XVI. The down-facing air intake to the carburetter, and the location of accessories are clearly shown.

Normal power rating for the "V" at 10,000 ft. is 305-335 h.p. at 3,500 r.p.m., and maximum output is 330-340 h.p. at 4,000 r.p.m. at 13,000 ft. A reduction gear of 1 to 2.5[illegible] ratio is fitted, and the weight, without airscrew hub, compressor and generator, is 720 lb. At maximum h.p. the weight per h.p. is 2.12 lb. The Rapier VI is rated at 360 h.p. at 4,000 ft., with a maximum at 5,800 ft. of 395 h.p.

POBJOY

Pobjoy Airmotors, Ltd., Rochester, Kent.

CONSIDERABLE operational success has been enjoyed by the compact little seven-cylinder radial Niagaras in Short Scions and Scion Seniors and General Aircraft Monospar models. For ultra-safe initial training the Pobjoy engine has proved very satisfactory in B.A. Swallows and in a rather different field of instruction the Niagara III is specified for the C.L.W. Curlew monoplane. The Niagara III and the Cataract III (which is a similar engine with slightly lower compression ratio) have 0.468:1 reduction gears and a normal speed of 3,300 r.p.m. The Niagara III gives 88 h.p. normal and 95 h.p. maximum, the fuel consumption then being 7 gall./hr. and oil 1.5 pints per hour. Both engines weigh 156 lb.

ROLLS-ROYCE

Rolls-Royce, Ltd., Derby.

GREAT activity due to Air Ministry orders tends to confine Rolls-Royce to the military field only; however, for commercial use, Kestrel XVIs are specified for the Scottish Aircraft Burnelli types and for South African Junkers. The Kestrel XVI is the latest of the most successful Kestrel range, and can be fitted with v.p. airscrew. The rating on 87-octane fuel is 690 h.p. at 11,000 ft. and 2,600 r.p.m., and a maximum output of 745 h.p. is given at 14,500ft. and 3,000 r.p.m. The take-off power is 670 at 2,250 r.p.m. The "XVI" reduction gear is of 0.632:1 ratio, and the dry weight of the engine is 975 lb.

VILLIERS-HAY

Villiers-Hay Development Co., Albermarle Street, London, W.1.

THE small frontal area and easy accessibility of the Villiers-Hay Maya engine makes it most suitable for light twin-engined commercial types. The rated output is 120 h.p. at 2,300 r.p.m., and 130 h.p. maximum at 2,600 r.p.m. The engine, which is intended as the forerunner of a six- and twelve-cylinder range of similar types, including supercharged models, weighs 275 lb.

Further Lodge Extensions

A NEW extension to the offices and the erection of a new works canteen follow on the recent enlargement of the Rugby factory of Lodge Plugs, Ltd. The new offices provide much increased accommodation for the general sales, export and advertising departments, and also for the technical and designs departments.

The factory extensions, which were completed a few months ago, have been equipped with entirely new machinery and are now in full swing. They allow output to be increased by nearly 100 per cent.